SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVIII.—No. 6. [NEW SERIES.] NEW YORK, FEBRUARY 9, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

THE HORIZONTAL PENDULUM.

The most minute measurements known to science are made by an instrument which depends for its action upon gravitation. It is a pendulum suspended in an exceedingly delicate manner on the principle of the torsion balance, and the theory of its operation will be understood by the following simple experiment. In Fig. 3, R R represents a rigid rod which rotates freely on points at its ends. To the center of this is attached a shorter rod carrying the weight, W. If the rod, R R is horizontal, the weight will evidently hang vertically, and if pulled aside will swing to and fro like a pendulum. Now, if the rod, R R, be raised until it becomes vertical, as shown in Fig. 4, then gravity has no directing influence upon the arm and its weight, and they remain indifferently pointing to any point of the compass to which they may be directed. But if the rod be inclined never so little toward the horizon, gravity will act sufficiently upon the weight, W, to direct the arm, A W, into a vertical plane passing through the pivots of the rods, R R, and the more inclined this rod the greater is the force required to deflect arm and weight.

The instrument based on this principle, and devised by Zöllner, a noted German astronomer, in 1873, is represented in Fig. 2. It consists of a tripod with leveling screws supporting a vertical column, to which are attached two projecting pieces, C C'. To these are fastened two delicate watch springs, R R, which support the weight W. The latter therefore constantly exerts a pull on each of the springs, R and R'. A counterpoise at P balances the weight of W and its attachment. The weight carries a mirror, M, which reflects into a telescope a distant divided scale. By means of the screw, L, the instrument is made as sensitive as desired by approaching to the vertical the line connecting the points of attachment of the wires. The instrument is exceedingly sensitive to change of level, and the slightest movement of the screw, N, is sufficient to cause the weight to move away from the reader.

When the weight is at rest, the suspending wires without

Fig 3.

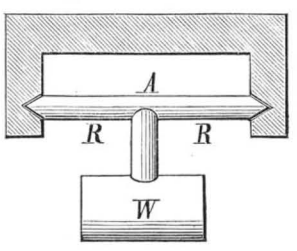
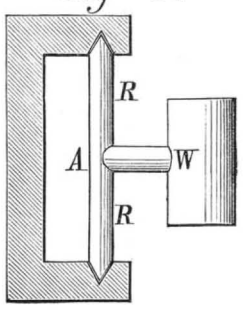


Fig 4.

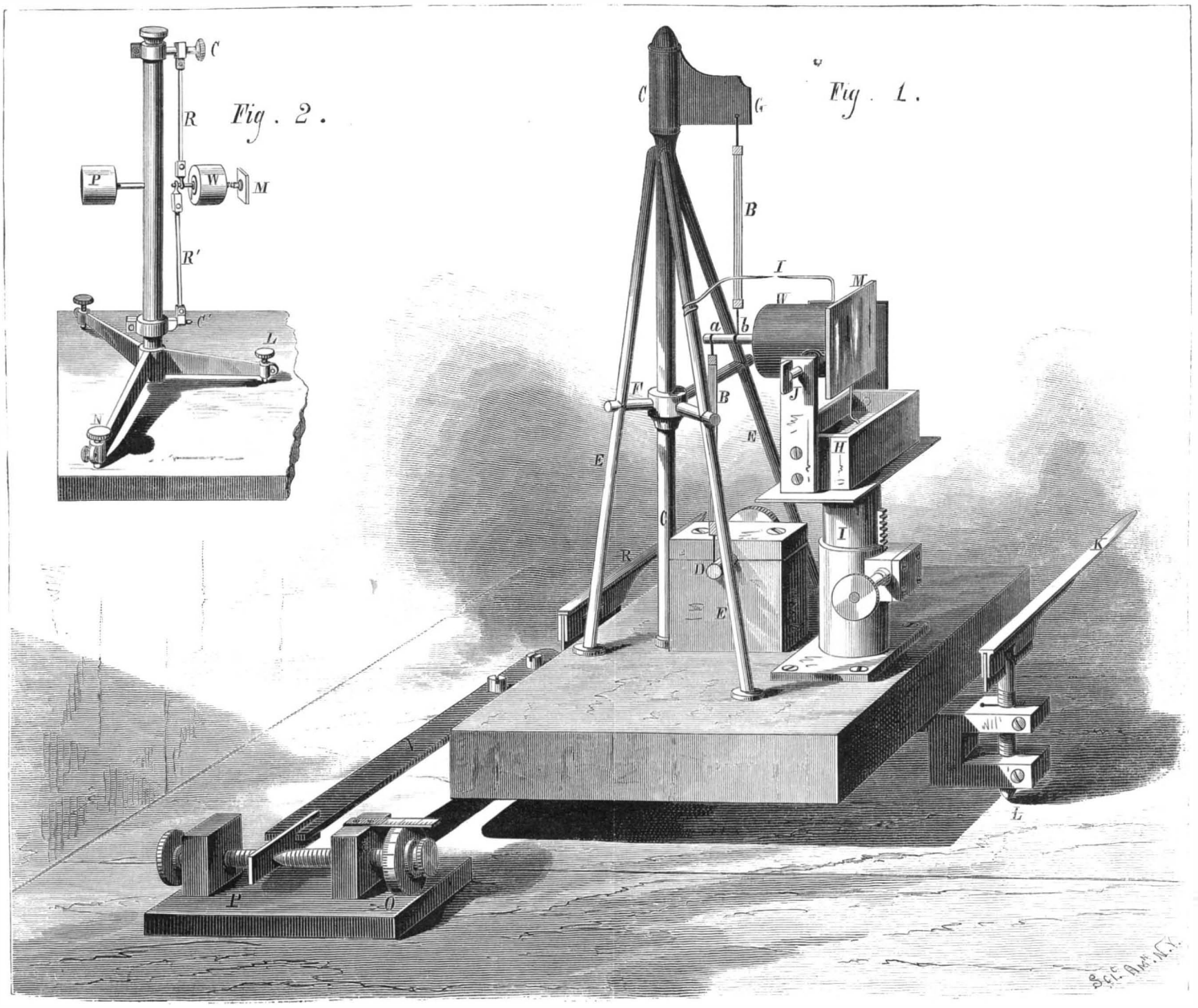


torsion, the mirror, M, facing the south point of the horizon, and the sun or moon on the meridian, the position of the pendulum is at the point zero. When either celestial body is to the east of the meridian it pulls the horizontal pendulum in that direction until the body reaches the meridian, when no further deflective influence is shown. Then as the body moves over to the west, the deflection takes place in that direction. Zöllner found the instrument so sensitive to these actions that he could obtain from the observed deflection of the pendulum approximate values of the masses and distances of the sun and moon expressed in units of the mass and semi-diameter of the earth. He has also pointed out that if it is found practicable to determine accurately the position of the horizontal pendulum when on the meridian to one minute of time, then the velocity of the propagation of gravitation can be measured even if it has eight times the rapidity of the transmission of light through celestial space, or 1,480,000 miles per second.

In the large illustration, Fig. 1, is represented the modification of Zöllner's pendulum, invented by Professor Rood, of Columbia College, in this city, and adapted by him to the measurements of minute changes in the dimensions of solid bodies. He has succeeded even under adverse conditions in measuring to the $\frac{1}{86000000}$th of an inch, the smallest linear magnitude which has yet been grasped within the compass of science. In order to render the column, C, rigid, Professor Rood attaches to it the long inclined braces, E. At J is shown the head of a screw, and another similar one is on the other side of W. To these screws are fastened spiral springs, which confine the motion of the pendulum within narrow limits, and aid in leveling the same. Also to the pendulum is attached a wire bent in zigzags, which enters a box, H, filled with olive oil. This is so adjusted as to bring the pendulum to rest after a couple of oscillations, the oil box having an up-and-down movement by the mechanism shown. I is an index or pointer for adjusting the pendulum with regard to the scale, so that the mirror may be brought into position to reflect the zero or center of the scale into the telescope. Professor Rood suspends his pendulum by strips of copper foil. Only one of the leveling screws,

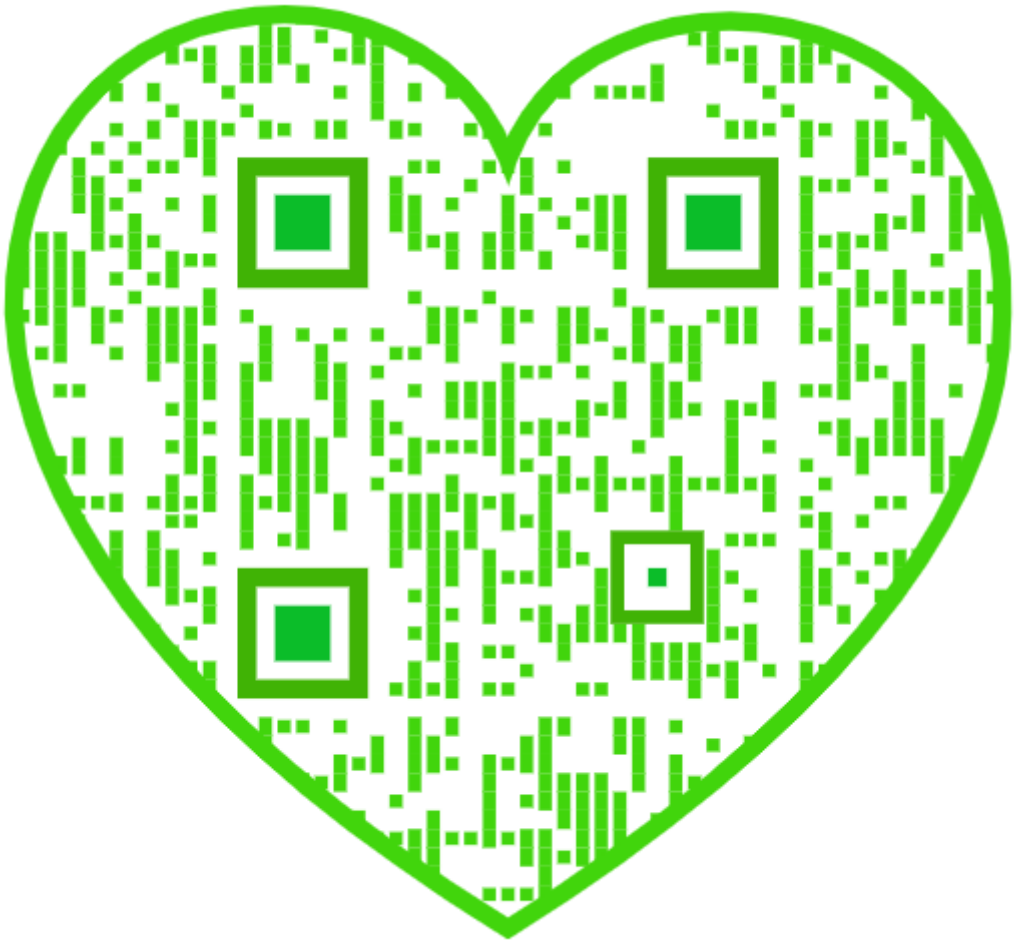
Fig. 2.

Fig. 1.



ZÖLLNER'S HORIZONTAL PENDULUM.

© 1878 SCIENTIFIC AMERICAN, INC



that at L, is shown in the figure. The arm, K, is connected with this, so that the screw can be turned through a very small angle. The levers attached to the two rear screws are marked R and N. One of these screws rested on the body whose changes in dimension were to be measured. It is evident that if one of these screws be moved up or down, the vertical plane, passing through the points of suspension of the copper foil bands, would be tilted, and hence the weight and mirror would swing into a new lateral position. The left hand screw attached to the arm, N, served as a micrometer. A scale placed under the telescope was reflected in the mirror and then read from the telescope, being thus magnified about 60 diameters.

To illustrate the delicacy of the apparatus, Professor Rood says that "children playing on an iron bridge 360 feet distant caused temporary deflection of one or two divisions, and similar deviations were caused by the lower notes in an organ in a neighboring church, the medium and higher notes producing no sensible effect." The general mode of experimenting is as follows: In all cases the micrometer screw (that moved by the lever, N) rests directly or indirectly on the body the change in the dimensions of which is the subject of study. It is first necessary to ascertain whether the different portions of the apparatus are at rest relatively to each other or approximately so. Afterward the value of a scale division can be obtained by repeatedly moving the arm attached to the micrometer screw by the aid of threads leading to the observer seated at the telescope. When this has been satisfactorily accomplished, the body to be experimented on is subjected to the desired influence, and the change in its dimensions noted; for example, the change in the longitudinal dimensions of a bar of iron, when magnetized, produces with this instrument a large and sudden deviation, and it is also possible to note the gradual increase in its dimensions, owing to the heat developed by the act of demagnetization. When it is recollected that with the best optical and mechanical means it has hitherto been hardly possible to measure quantities smaller than $\frac{1}{200000}$ of an English inch, the field which the use of the horizontal pendulum opens may be understood.

Our readers will find a very complete detailed description of Professor Rood's instrument, with directions for experimenting, in the SCIENTIFIC AMERICAN SUPPLEMENT, in which the article whence the foregoing particulars are taken will appear in continuation of the valuable series on the "Minute Measurements of Modern Science," from the pen of Professor A. M. Mayer.

MEDICAL PROGRESS IN 1877.

The London *Lancet* devotes a large portion of a recent issue to a very full summary of the advances made in medicine and surgery during the year just closed. Of these the most important are the following: M. Paul Bert has published an extensive work on the effect of variations of pressure on the body, and he shows that the observed effects of diminished pressure are exclusively due to a diminution in the tension of the oxygen in the air, and consequent predisposition to asphyxia; while on the contrary, increase of pressure up to three atmospheres occasions more active intra-organic changes, and when the pressure reaches five atmospheres the oxidizing processes either cease or become modified in such a way as to be inconsistent with the maintenance of life. Guttmann, Frickler, and Oertmann have demonstrated that the absorption of oxygen is independent of the mechanical acts of respiration. Richet has determined that when perfectly fresh the gastric juice contains only mineral acids, but that after standing for some time a kind of fermentation is set up in which much free organic acid is formed that on analysis proved to be lactic acid. It is believed to be beyond doubt that lactic as well as butyric and acetic acids are often either introduced into the stomach or are formed in it as a product of fermentation.

By far the most interesting discovery of the year in physiology is that made by Boll, that the retina possesses in health a peculiar red color, which is constantly being destroyed by the influence of light, and is as constantly being regenerated by the ordinary processes of nutrition. The "vision red" or "erythopsin," as its discoverer names it, attains its maximum after a night's rest and sleep, or when an animal has been kept for some hours in darkness; it is soluble in solutions of the biliaryacids and in glycerin, and probably plays a part in the production of the red reflection from the fundus of the eye seen on ophthalmoscopic examination, as well as in all probability in the ordinary acts of vision.

The most important progress in the department of pathology is that toward the establishment and diffusion of the opinion that minute organisms are concerned in the progress of acute infectious disease. Chaureau has shown that the horse is peculiarly receptive of the vaccine virus and is capable of reproducing it in remarkable purity and force.

In therapeutics salicin has been found to be a curative of ague, coryza, and some cases of neuralgia in which quinine has failed. Three cases of traumatic tetanus, one with a temperature of 108°, have been cured by chloral hydrate. Dr. Robert Bell, of Glasgow, has claimed for chloride of calcium remarkable power of controlling and curing many forms of tubercular disease. A large number of cases have been published showing the value of salicin, salicylic acid, and the salicylates in acute rheumatism and other febrile affections. In surgery Professor James Wood, of this city, has caused the reproduction of a new lower jaw bone, by the periosteum left in an operation for the removal of a jaw recussed from phosphorus.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... **$3 20**
One copy, six months, postage included **1 60**

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.

☞ Subscriptions received and single copies of either paper sold by all the news agents.

VOL. XXXVIII., No. 6. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, FEBRUARY 9, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

Alloys (2) (40)..... 91
Astronomical notes..... 90
Bell, electric (36) 91
Bicycle (1)..... 91
Blasting (22)..... 91
Brass, casting (10)..... 91
Business and personal..... 91
Calliper making *..... 85
Chelodine, long necked *..... 87
China to India 88
Cider mill, Sikes' *..... 86
Coil heaters (2)..... 91
Cotton harvester, Powell's *..... 86
Desert lands..... 84
Designs patented 92
Diet and drinking..... 87
Digging machine, Knight's *..... 83
Emery wheels (11)..... 91
Forging, steam (26)..... 91
Fowl monstrosity *..... 89
Fuchsias (27)..... 91
Gases, explosive (15)..... 91
Gravity a mode of motion *..... 80
How regarded, the Scientific Am 85
Hydraulics (23) (29) (33)..... 91
Inventions, mechanical..... 89
Inventions, new..... 83, 84
Mail of the metropolis..... 81
Medical progress in 1877..... 80
Mineral oil fuel..... 81
Minerals 91, 92
Moon, size of *..... 89
Notes and queries..... 91
Obelisk in England 87
Observatory, national..... 84
Patent decisions..... 84
Patent office employees..... 81
Patents, American in England *. 90
Patents, official list of..... 92
Pendulum, Zollner's horizontal * 79, 80
Phonograph..... 86
Phosphorescent quinine sulphate 87
Photo hash 90
Postal card, double..... 87
River impurities, detecting..... 81
Ruhmkorff, death of..... 81
Safe, folding-door fireproof *..... 82
Salmon, Amer., in New Zealand. 87
Samples by mail..... 84
Sand blast (39)..... 91
School at Kolapore *..... 87
Smokestacks, setting up (18)..... 91
Steam boilers and engines (6) (7) (9) (13) (14) (19) (20) (35) (36)..... 91
Stick to the law..... 80, 81
Sulphur, brittle (33)..... 91
Sunflower and malaria..... 90
Telephone and telegraphy..... 89
Telephonic alarum *..... 89
Thill coupling, Beard's *..... 89
Torpedo warfare *..... 82
Trees, longevity of..... 88
Washington correspondence..... 84
Whales and whalebone *..... 88
Windmill, Smith's improved *.... 83
Woods, turnery..... 90
Yachts, steam (2) (7)..... 91

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 110,

For the Week ending February 9, 1878.

Price 10 cents. To be had at this office and of all newsdealers.

I. ENGINEERING AND MECHANICS.—Tube Wells for Large Water Supplies.—Paper read before the Society of Engineers, London. By ROBERT SUTCLIFF. Most favorable soils, and Water Supply obtained. Water for Refrigerating Purposes. How to obtain Clear Water. Rapidity of Driving. How to Drive through Dense Strata. Description of several Wells, the Water Supply Obtained, Cost, etc. 5 illustrations.

New Steam Dredger. Dimensions and General Particulars.—The Sandusky Water Tower. Dimensions and 2 illustrations.

New Method for Determining the Wind's Velocity. By JOHN H. LONG. Paper read before the Kansas Academy of Science. Experiments, Tabulated Results, and one illustration of Apparatus employed.

London Steam Fire Engine, with 1 Engraving.—Improved Ventilating Fireplace, 2 engravings.—Progress of the English Channel Tunnel. A Triple-wick Lamp. A Gigantic Pendulum.

II. TECHNOLOGY.—The Technology of the Paper Trade. By WILLIAM ARNOT, F.R.S. Early History; Invention of the Beating Engine; Introduction of Soda, etc., and the First Machine-made Paper. Cameron's Machine; the Fourdrinier Machine. Interesting Picture of the Old-time Mill. The Mill of Modern Times; the Sorting, Boiling, Breaking, Poaching, and Beating Processes; Progress of the Pulp through the Machine; the Draining; the Rolls; the Cooling Cylinders; the Size Bath; the Drying Process; Preparation of Bleaching Liquors. An Exceedingly Clear and Comprehensive Treatment of every Operation. Raw Fibrous Materials, their Characteristics and Treatment preparatory to Pulping. Cotton, Straw, Linen, Hemp, Esparto, Wood. Instructive Accounts of the numerous Chemical and Boiling Processes. This Treatise deals with every department of Papermaking with Clearness and Minuteness, Describing the Latest and Best Processes, the Best Machines in Use, with Practical Particulars, Statistics, Profit, etc.

Neidlinger, Schmidt & Co.'s Malt house. The Furnaces, Kilns, etc., general Dimensions, and 1 illustration.—Improved Stitching Machine for Bookbinders. 2 engravings.—Improved Self-Cleaning Cistern Filters. The Aerating Filter, etc. 3 illustrations.—Improved Cotton Opener. 1 illustration.

A Shuttle and How it is Made. 3 illustrations.

Photo Exhibits of the Exhibition of the South London Photographic Society. Scenographs; Portable Photographic Apparatus; Plate Holders; Contrivances for Cleaning Plates; Pre-Lighting and Supplementary Lighting of Negatives; Convenient Hot Water Bath; Packing Wet Plates; Dropping-Tube; Simple Filter, etc., etc.

Papyroxyline. Processes, Recipes, and How to Use.

III. CHEMISTRY AND METALLURGY.—Adulteration of Ground Madder, and of its Preparations. By M. C. BENNER.—On a Distillatory Apparatus. By JOSEPH P. REMINGTON. 1 illustration.—Separation of Lead, Zinc, and Silver. By F. MAXWELL MYTE.

IV. NATURAL HISTORY, GEOLOGY, ETC.—The Loss-Formation of Northern China.—Uranium Minerals in North Carolina. By W. C. KERR, State Geologist.—Large Bowlders in New Hampshire.—A Boy's Trip to the South African Diamond Fields.—The Limits of Natural Knowledge.—Remarkable Artesian Well.—Mars and her Moons.

V. AGRICULTURE, HORTICULTURE, ETC.—California Fruits in California.—Asparagus-forcing in Paris.—Hybridization of the Monukka and Black Hamburgh Grapes.—Strawberries.—California Oaks.—Oregon Fruits.—Grape Culture under Glass.

VI. MEDICINE AND HYGIENE.—The New Jersey State Asylum for the Insane. General Description of the Buildings, with Perspective and Bird's Eye View Engravings, Plan, with Dimensions, etc. The Culinary Department, Ventilation, the Laundry Building, the Bakery. These Departments contain Machinery and Apparatus of the Most Successful Form and Arrangement for large establishments. Gas, Water, Ice Pond, Live Stock, and Slaughter Houses, etc. Causes of Insanity, Predisposing and Exciting. Insanity from the Diseases of Infancy. Functional Causes of Derangement. Emotional Causes. Physiological Phenomena of Derangement.

VII. CHESS RECORD.—Biographical Sketch of W. S. Hallock, of Mo., with Portrait.—Problem by Alonzo Townsend.—Problem by Samuel Loyd—Problem by L. W. Mudge.—Miron's Tournaments Continued.—Paris Problem Tourney.—Five Enigmas by Samuel Loyd.—Telegraphic Match between New York and Philadelphia.—Solutions to Problems.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ Single copies of any desired number of the SUPPLEMENT sent to one address on receipt of 10 cents.

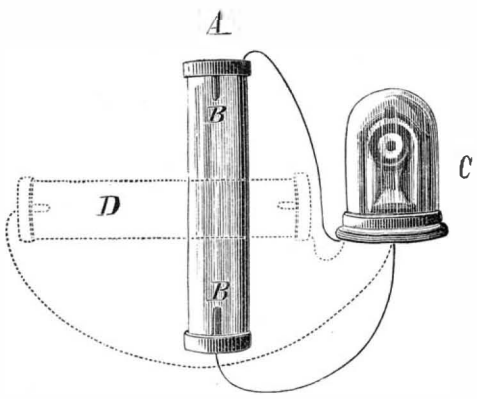
IS GRAVITY A MODE OF MOTION?

IN his 24th series of experimental researches Professor Faraday describes the experiments undertaken, the results of which, he says, though "negative, do not shake my strong feeling of the existence of a relation between gravity and electricity, though they give no proof that such a relation exists." In 1859, returning to the same investigations, he reflects upon the infinity of actions in nature, in the mutual relations of electricity and gravity, which would come in play: he pictures the planets and comets, charging themselves as they approach the sun; cascades, rain, rising vapor, circulating currents of the atmosphere, the fumes of a volcano, the smoke in a chimney, become so many electrical machines. Many more experiments were made by Faraday, but the results were still negative, and the experimenter did not accept them as conclusive. In this position the question remains to the present day; it may be, as Professor Jevons has suggested, that the effect was too slight to be detected, or it may be that the arrangements adopted were not suited to develop the particular relation which exists.

The force of gravity, while conforming on one hand to experience, is on the other a mysterious existence. We know that it is proportional to mass and utterly independent of present or intervening matter. In common with light, sound, and other influences emanating from a point, the law of decrease of its intensity is inversely as the square of the distance, yet, unlike the former, its action appears to be absolutely instantaneous.

The hypothetical ether which transmits light undulations which according to Herschel exercise a pressure of 17 billion pounds per square inch, and is harder and more elastic than adamant, is not influenced by gravitation as matter is, but its density and mechanical properties are modified by gravity in a way yet unexplained. Science thus far has stood silent before this mysterious influence, and there have not been wanting those who, like the late Professor Vince of Cambridge, have held that the force could be explained in no other way than by ascribing it to the immediate and ever present action of the Deity, an easy way of settling problems not wholly satisfactory to scientific minds.

The reader will now perceive the possible importance of an experiment which in place of Faraday's negative results has caused positive ones, and by which an electric current seems to have been produced by the direct action of gravity alone. Professor F. J. Pirani, Lecturer on Natural Philos-



ophy and Logic in the University of Melbourne, writes to Professor Clerk Maxwell (who communicates the fact to *Nature*) with reference to the fact that a greater electric motive force is required to produce a given current between zinc electrodes in a solution of sulphate of zinc when carried upward instead of downward, testing the question whether a current should exist if two zinc electrodes connected by a wire are immersed in a solution of sulphate of zinc, the direction of the current being from the upper to the lower electrode. Professor Pirani used a glass tube, A, 18 inches long, filled with a saturated solution of sulphate of copper and closed with copper caps, B, with wires attached. This, on being attached to a Thomson static galvanometer, C, produced a deflection of 200 divisions when the tube was held vertically, the direction of deflection being reversed when the tube was reversed. When the tube after being held vertically was placed horizontally, as at D, the deflection diminished, and after several minutes the index came to zero.

Professor Maxwell has repeated the experiment, and considers that the temporary permanence of the deflection after the tube is placed horizontally indicates the possibility of something being shifted from end to end when the tube was inverted, but which remained where it was when the tube was only laid on its side.

Further verification of this experiment will be looked for with the greatest interest, as, if its present import be substantiated, the possible conversion of gravity into electricity places that force at once in the same category as light and heat, and indicates future possibilities in discovery over which now it would be idle to speculate. One, at least, may be the measurement of the velocity of propagation of the influence, and the means for determining this are probably already in existence, as will be seen by an examination of the horizontal pendulum, to the illustration and description of which we devote the first page of this issue.

STICK TO THE LAW.

The Commissioner of Patents has recently issued a circular to the Patent Office Examiners requiring them to see that specifications contain specific statements as to the state of the art prior to the applicant's invention, and that if a de-

© 1878 SCIENTIFIC AMERICAN, INC

vice is an improvement on a previously patented article, that fact be also declared: the object being to enable any one reading the patent, even if unskilled in patent matters, to perceive not only what is claimed but the exact condition of the art on which the invention is based. The section of the Patent Laws relating to specifications (§ 4888) requires that the description of the invention "shall be in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, and use the same," and that the invention or discovery claimed shall be particularly pointed out. There is nothing in the law requiring any specific statement as to the prior condition of the art or science, nor the embodiment of information which will post people unskilled in the subject matter, but on the contrary the tenor of the statute plainly presupposes knowledge which may be considered as at least that of an intelligent mechanic or student in the particular art or science affected by the invention. Such an amendment of the law (for such it amounts to) by the Commissioner, besides not being clearly warrantable, is objectionable because it complicates the formalities incident to the application for a patent, and makes the preparation of the same more difficult and laborious. This is diametrically opposite to the proper tendency of innovations, which should have as a cardinal object the simplification of every branch of our patent system, so that eventually the obtaining of a patent may be attended with as little ceremony and work as that of a copyright now is. It should be remembered that the majority of inventions are made by men whose pecuniary resources are too often inversely as their genius, and to whom the conception is mainly suggested by the practical needs which they see within their own immediate horizon. These inventors have neither the means, time, nor opportunities to study up the state of a great art or science; many have not the attainments requisite to make such an investigation; and therefore, to require them to do so would be burdensome to a degree hardly to be appreciated by those not familiar with the sacrifices these men now make to obtain a patent. Again, there is a large corps of skilled examiners in the Patent Office paid out of the inventors' money to do this very specific duty, and provided with all the facilities for doing it. To remove the labor from them and put it on the shoulders of the inventor would simply be to make the latter pay for work and still do it himself.

General Spear's administration of the Patent Office has been notably successful and satisfactory to inventors, and we are the more inclined to look to him for beneficial reforms and improvements. While his object in issuing the circular above referred to is laudable, we think that for the reasons stated the measure is ill-advised.

PATENT OFFICE EMPLOYEES TO BE DISGRACED.

Representative Douglas has brought a bill into the House which makes it unlawful for any past employee of the Patent Office to act as patent agent or attorney within two years after his connection with the office shall have ceased, and imposes penalties on any present employee of the United States who shall knowingly recognize a person so practicing. The idea is to correct certain abuses alleged to exist and to prevent impositions through knowledge acquired in Government service. The above measure is conspicuous for nothing but an endeavor to induce Congress to interfere where it has neither the authority nor reason for so doing. Why does not Mr. Douglas go the whole length and provide that all Patent Office employees shall after their service is expired be regarded as criminals and kept under police scrutiny for two years?

THE MAIL OF THE METROPOLIS.

Enough letters, circulars, and postal cards annually pass through the post office in this city to extend, if placed end to end, from one side of the Atlantic to the other; or, in round numbers, they aggregate over 240,000,000 per year. To this must be added over 100,000,000 newspapers which in the same period are dispatched, and then a roughly approximated idea of the enormous mass of mail matter which is handled in the lower floors of the new Post Office building will be obtained. It is curious to remark that the aggregate of letters is more than half of the total number dispatched in all France, and over four times as many as are forwarded in Russia, while a notion of how extensively news and information is disseminated in this country may be obtained by comparing the above total of newspapers transmitted from New York alone with that representing the aggregate number sent in all Germany (2,300,000), or even with the same in all Great Britain, which is only about fifty per cent. in excess.

To explain with any detail the elaborate yet very simple system perfected by Postmaster James, and under which the mail of the metropolis is handled, would require far more space than is here at our disposal, but there are some interesting features which are worth notice. At the outset the public is made to distribute its own mail by dropping its missives into boxes marked with names of States and large cities, and from these receptacles the letters are constantly being gathered and transmitted to the cancellers, who affix the post mark and obliterate the postage stamp. It is well known that this is done by the use of the hand stamp, and that, simple as the problem seems to be, no one has yet devised a mechanical system of cancellation which has been deemed worthy of adoption. Machines have been tested in the New York Post Office, but have been discarded, and the prevailing opinion among the experts there is that until the public can be made to produce letters uniform in size and thickness, and always with the stamp in a certain position, no purely mechanical contrivance is likely to succeed, or even advantageously compete with hand work. The skill of the cancelling clerks is such that they can now mark on the average 100 letters per minute, and a machine to be of value would of course have to do much better than this.

After the letters are stamped they are separated into bundles for States and large cities, and sent to be further distributed on board the railway postal cars on the different routes, or in many cases they are made up into packages for direct delivery to their different destinations. There is one point here that inventors might look to, and that is the way the bundles are done up. It was the late Mr. A. T. Stewart, we believe, who once reproved a clerk for putting an extra and unnecessary turn of string on a bundle. That estimable merchant would doubtless be horror-stricken could he witness the numerous turns of cotton twine which are deemed needful to hold a few letters together. We asked why, and the reply was "custom," and that "the Government issued that kind of string." It seems to us that a simple elastic fastening device might easily be contrived which could be affixed in much less time, and which might be used until worn out. Security is of course the first necessity, and readiness of application the second. Some philanthropic inventor might also devise a system of mnemonics which would facilitate the labor of the assorters in remembering names of individuals, of counties, of post offices, and box numbers. The skill these men attain now is wonderful. Every assorter of city letters is obliged to remember 2,500 names with the corresponding box numbers, and, besides, to keep track of the changes constantly occurring; and he must be able besides to use the knowledge as rapidly as he can glance at the superscriptions of the letters and toss them into the proper receptacles. To show how this faculty can be cultivated, the records of a recent examination exhibit degrees of proficiency represented by from 99·67 to 64·54 per cent.

The clerks also become exceedingly expert in weighing letters by merely holding them in their hands for an instant in distributing them, and on their individual estimate they toss the missive aside as underpaid. It is afterward weighed and delivered in the city with the amount due stamped upon it.

Still another kind of expertness is to be found among the newspaper distributors. Each employé stands before a semicircular tier of pigeon-holes, the openings in which are a little over a foot square. In some tiers there are 170 of these receptacles, yet the distributor in front of them tosses folded newspapers into the proper openings, often fifteen or more feet distant, as rapidly as he can glance at the addresses. Another field for expert talent is in the foreign letter department to decipher addresses, and here the qualifications are simply a knowledge of all modern languages, a genius for deciphering hieroglyphics which seemingly would make light of cuneiform inscriptions and Egyptian papyri, and an intuition of what people mean to write when they don't do it. The gentleman who unites in himself these phenomenal capacities informs us that of all letter writers the Italians are the worst, and he fully verified his statement by exhibiting a collection of missives, the addresses of which contained such words as "uofbrg," which we were told meant "Mulberry," and which to add to their difficulty embodied all the complications of bad caligraphy, pale ink, and blots.

There is room for the exercise of no small skill, especially at guessing, in the searchers' department. Hither comes every irate citizen to know why his letter has not reached its destination, and in the majority of cases he departs with mitigated and somewhat crest-fallen feelings on discovering that he has left out the essential portion of the address, or very possibly written only his correspondent's name and forgotten the address altogether. It is an anomalous fact that people on one hand should insist on the absolute accuracy of their mail service, and yet prove so extraordinarily careless themselves in regard to their correspondence. It is a common sight in this city to see papers and sometimes letters left on top of fire telegraph boxes, and as for defective addressing, no less than 152,266 letters misdirected came to the New York Post Office last. year. By way of proving that some at least of this carelessness was not due to ignorance, our attention was called to the fact that over 3,500 of these letters came from banks, where, of all business houses, accuracy is supposed in greatest degree to exist. It is admirable proof of the efficiency of those charged with sending these letters on the right path that out of the above total 147,640 were redirected and forwarded. The amount of labor involved in overhauling all the directories of the country and the geographical and local knowledge requisite was of course very great.

The Post Office is subjected to constant inconvenience by the mailing of so-called "unmailable" matter. No doubt hundreds of people are anathematizing the mails for losing their Christmas gifts, when the articles are probably snugly entombed in the dead letter office, whither they have been sent after a temporary sojourn in the office where dispatched. There is quite a museum in the New York office of this material, and it is a most heterogeneous collection. Here are bottles of hair tonic, packages of flour, dainty fancy work made evidently by fair hands, but ruthlessly consigned to this limbo because not properly prepared, jostling big bundles of shoe blacking. Some damsel is minus her tresses, for a packet of female hair loosely rolled in newspaper occupies a corner. No one tries to forward these things. They go to Washington, and, Christmas gift or not, unsympathizing buyers bid them in at perennial auctions. Another class of individuals try to evade the revenue laws by making the Post Office an accesory, but they always fail. Whenever a bulky letter comes from Europe the owner is requested to appear at the office, when a custom house official politely insists on seeing the packet opened, and, if the contents are dutiable, requires payment before delivery.

HEINRICH DANIEL RUHMKORFF.

In announcing the death of this noted man, who has been so closely identified for years with the progress of electrical science, and whose name is so widely known in connection with one of the most remarkable pieces of apparatus belonging to a philosophical cabinet, it would be out of place in a scientific journal to make no more than a mere passing allusion to his life and labors. Ruhmkorff was, as his name indicates, a German, and was born at Hanover in the year 1801. Beginning the business of life in England, where he remained for some years, he afterward went over to France as a journeyman and became an assistant in the *atelier* of M. Chevalier. Here he seems to have become imbued with a love for that branch of physical science which was destined to make his name famous. Having gained sufficient experience under the friendly guidance of Chevalier, he soon afterward ventured into business on his own account as a maker of philosophical instruments, and bringing to bear on all of his work a reasoning intelligence that had been lacking in his competitors, the merit of his instruments soon attracted the attention of scientists, who became thenceforth his friends and partners.

It was in 1831 that Faraday made the great discovery of electrical induction, and in 1833 our own Dr. Henry, experimenting with coils of insulated wire, discovered the fact that a bright spark is produced in long voltaic circuits when contact is suddenly broken, an occurrence that does not happen when the circuit is short. Faraday investigated this, and the next year demonstrated the fact that the spark was an effect of what he termed the "extra current" induced in the convolutions of the coil by the current traversing the other coils in their close vicinity, and that the induced extra current was in one direction upon contact being made and in the reverse direction upon the circuit being broken, so that when the circuit was alternately made and interrupted, the effect of the extra current was to alternately diminish the principal one by inductive retardation, and to produce a secondary current in the opposite direction. The inductive effects were also found to be greatly increased by the insertion of a core of iron within the coil; or, better still, by a bundle of iron wires, by means of which a stronger induced current could be obtained.

The subject was also investigated by Masson, Brequet, and Fizeau, in France. Having collected the various results obtained by these different investigators and combined them into a practical form, M. Ruhmkorff, after a long series of interesting experiments, produced the first induction coil, now known by his name. This was exhibited in 1851; and, although it produced sparks not much more than an eighth of an inch in length, it caused a profound sensation among scientists and at once gave its inventor a world-wide reputation.

A serious obstacle to the success of the first induction coil was the retardation of the main current by the extra current when the circuit of the coil was closed. This defect was greatly diminished by M. Fizeau, who invented a condenser, by means of which the extra current was stored up, at the moment of breaking the circuit, to be again immediately utilized for increasing the main circuit when again closed. By the application of this and the inventions and suggestions of others, as well as by his own experiments, M. Ruhmkorff gradually brought his coils up to their present state of improvement. While allowing Ruhmkorff all the credit which is justly his due in connection with the development of this apparatus, we should not forget to point out what has been done by our own countrymen. For instance, Professor C. G. Page, of Salem, Mass., published, in 1836, the first account of an induction apparatus consisting of a primary coil with a secondary coil wound upon it of many times its own length. As an acknowledgment of merit, Congress granted him, some years afterward, a patent on his invention. Professor Page was also the originator of the automatic circuit breaker. Ritchie, of Boston, in 1857, by an improved method of winding the fine wire, vastly improved the induction coil, and made it possible to use with success a wire of several hundred thousand feet in length, while the limit in the instrument as constructed by Ruhmkorff was about ten thousand feet only. Ritchie's improvements were quickly adopted by Ruhmkorff, and, it is said, afterward claimed by him as his own invention.

DR. VOHL, of Cologne, has adopted an ingenious method of determining the impurities in the Rhine, which consists in analyzing the boiler incrustations of the river steamers, as well as the concentrated residues remaining in the boilers after passing over a given distance. Arsenious acid and other poisonous substances were found.

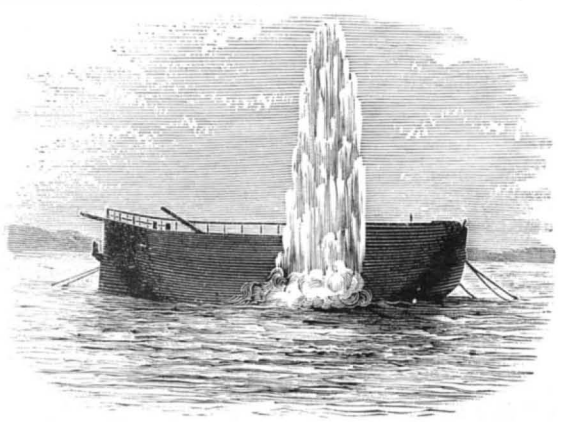
MINERAL OIL FUEL.—The neighborhood of the naphtha springs of Bakou has suggested the idea of using mineral oil as fuel for the Russian flotilla in the Caspian. Experiments on the boilers of three vessels have proved so satisfactory that the boilers of four other vessels will be adapted to the new system.

© 1878 SCIENTIFIC AMERICAN, INC

MODERN TORPEDO WARFARE.

The torpedo is one of the most efficient agents in modern warfare, and the application of electricity and new explosive compounds have made it a foe greatly to be dreaded. No less than twenty-five ships were sunk by the Confederates during the rebellion by the use of the electric torpedo, and the recent execution they have accomplished on the Danube is well known. Within twenty years great changes have been made in the torpedo. The infernal machines strewn in the Baltic by the Russians twenty years ago were small can-

Fig. 1.



isters of powder, ignited by concussion. These were dangerous to friend and foe alike, and the explosion of gunpowder was insufficient to effect any material injury. All this has been remedied. Electricity is nowadays employed as the igniting agent, and those terribly violent explosives, gun cotton and dynamite, are used. We copy the following interesting matter from *Nature:*

Electric torpedoes may be broadly divided into two classes, offensive and defensive torpedoes. The latter are employed for the protection of harbors, channels, and roadsteads; the former, in the shape of drifting or spar torpedoes, are carried to the attack in small swift-sailing steam launches. In England compressed gun cotton is generally used, but on the continent dynamite is the favorite. The gun cotton is pressed into cakes of disk-like form, and while still wet the slabs are stored away in the magazines. In this moist condition the compressed pulp is not only non-explosive, but actually non-inflammable, except one possesses the key to its detonation. This is nothing more than a dry cake of the same material, which on being detonated by a few grains of fulminate brings about the explosion of any wet gun cotton in its immediate neighborhood. The possibility of communicating explosion in this way by vibration instead of by spark or flame is the germ of a system of counter-mining, or torpedo annihilation, which bids fair to develop into a particularly effective means of defense against these terrible machines. Dynamite is similarly exploded to gun cotton.

Dynamite and gun cotton explode with something like four or five times the force of gunpowder, and for this reason a very destructive charge may be confined within a comparatively small space. In the case of moored torpedoes there is no limit to size, but for a spar torpedo the charge must be considerably smaller, or it would destroy both the attacking and the attacked. A big moored torpedo of 500 lbs. of gun cotton has been found, when sunk in forty feet of water, to be fatal to a strong ironclad if the latter happens to be within this distance. Probably no ironclad could withstand this terrible volcano if it were to erupt in contact with the vessel's sides. Such a torpedo throws up a cone of water 60 feet in height, with a diameter at its base of no less than 220 feet. Its general form is shown in Fig. 2.

The fish torpedo is of very elaborate construction. The long tube is divided into three compartments: the head, which contains the explosive charge, the reservoir, in which the compressed air is stored, and the machinery by means of which the stored-up energy is converted into a propelling force. The air is compressed to the extent of 600 lbs. on the square inch. The torpedo, when properly charged, will do a journey of a mile or mile and a half under water, the first 1,000 yards being got over at a rate of no less than 20 miles an hour, and if unaffected by tide or current, the machine will proceed in a perfectly straight direction. It floats at any distance under water that may be desirable, but is usually made sufficiently buoyant to swim at eight feet from the surface; it explodes on striking any object, but the machine is so contrived that if it fails to strike, then it floats to the surface, and a trigger guard renders the fish at the same time innocuous, and permits of its recapture without risk. Ingenious as the little creature is, there has been no authenticated employment of it during the present war.

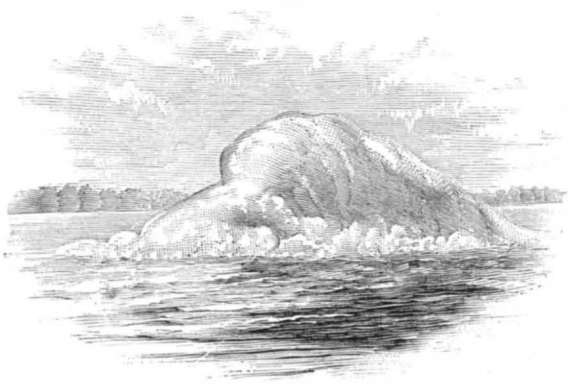
On the Danube the spar torpedo alone seems to have been used against Turkish monitors. The Turkish ironclad at Matchin was the victim of two torpedoes of this class, the first of which was ignited by the crew of the launch by electricity, and the other on concussion with the vessel attacked. These Russian torpedoes are said to be innocuous at a distance of ten feet from the seat of explosion, and hence those in the launch do not suffer much except from the water that is thrown into the air. From the fact that small batteries in the boat are used to fire the charges, we may safely conclude that their explosion is brought about by a platinum wire fuse, which, together with a few grains of fulminate, would determine the detonation of dynamite or gun cotton.

In the case of moored torpedoes depending for their ignition upon electricity, many points of scientific interest have recently been brought to light. Some experiments undertaken in Denmark two or three years ago showed most conclusively that dynamite torpedoes cannot be placed close together without incurring the danger of one charge bringing about the explosion of others. A dynamite torpedo of 150 lbs. ignited in 10 feet of water was found capable of exploding other charges at a distance of 300 feet by the mere vibration imparted to the water; so that in constructing coast defenses with dynamite torpedoes it is absolutely necessary to keep them far apart from one another. Another point was also noted. A current of electricity, if it emanates from a powerful frictional electric machine, traversing one of a bundle of wires, will induce a current in the other wires, and thus bring about the explosion of torpedoes other than that which the operator on shore desires to ignite. It is these facts particularly which have led to the development of a system of counter-attack, and have enabled our sailors to devise a means of defending themselves from the terrible sea monsters. Both dynamite and gun cotton are peculiarly sensitive to vibration—indeed their detonation, as we have seen, is brought about by no other cause—and hence a captain of a man-of-war by exploding counter mines in his vicinity may soon get rid of any lurking torpedoes lying in wait for him, at any rate if they contain a nitro-glycerin compound, and so speedily clear a way for his ship.

A crinoline of spars and wire rope may be employed to catch the fish torpedo, provided it is not a very large one, and the net is at some distance from the ship; but heavy moored torpedoes have been hitherto considered too dangerous to approach, so that marine countermining must prove invaluable. The spar or drifting torpedo cannot be dealt with by nets or booms alone, and in this case the only plan would seem to be to meet attack with attack and beat off launches with other small boats. That all ironclads in time of war will have to be surrounded by lesser craft as a protection is a matter that we may now take for granted, as also that such vessels must be provided with some powerful means of illumination—the electric light, for instance—to prevent swift, low-lying torpedo launches from approaching unperceived at night time.

Special schools of instruction for acquainting officers with the science of electricity and explosives have for some time past been established, and there is indeed scarcely a naval power which has not paid attention to submarine warfare; consequently we may expect to see future battles upon the sea carried on just as much under the water as above it. In England, at the Royal Naval College at Greenwich, instruction in the experimental sciences now forms one of the most important items in the curriculum. France has its naval torpedo school at Boyardville, where both officers and seamen are made acquainted with the principles of submarine warfare. Germany practiced torpedo warfare to such good purpose seven years ago that the magnificent fleet of the French never once ventured to visit the coast of the Fatherland. Both at Kiel and at Wilhelmshaven are to be found torpedo depots and a well organized staff of instructors. Lastly the news comes to us from Russia that the Czar has

Fig. 2.

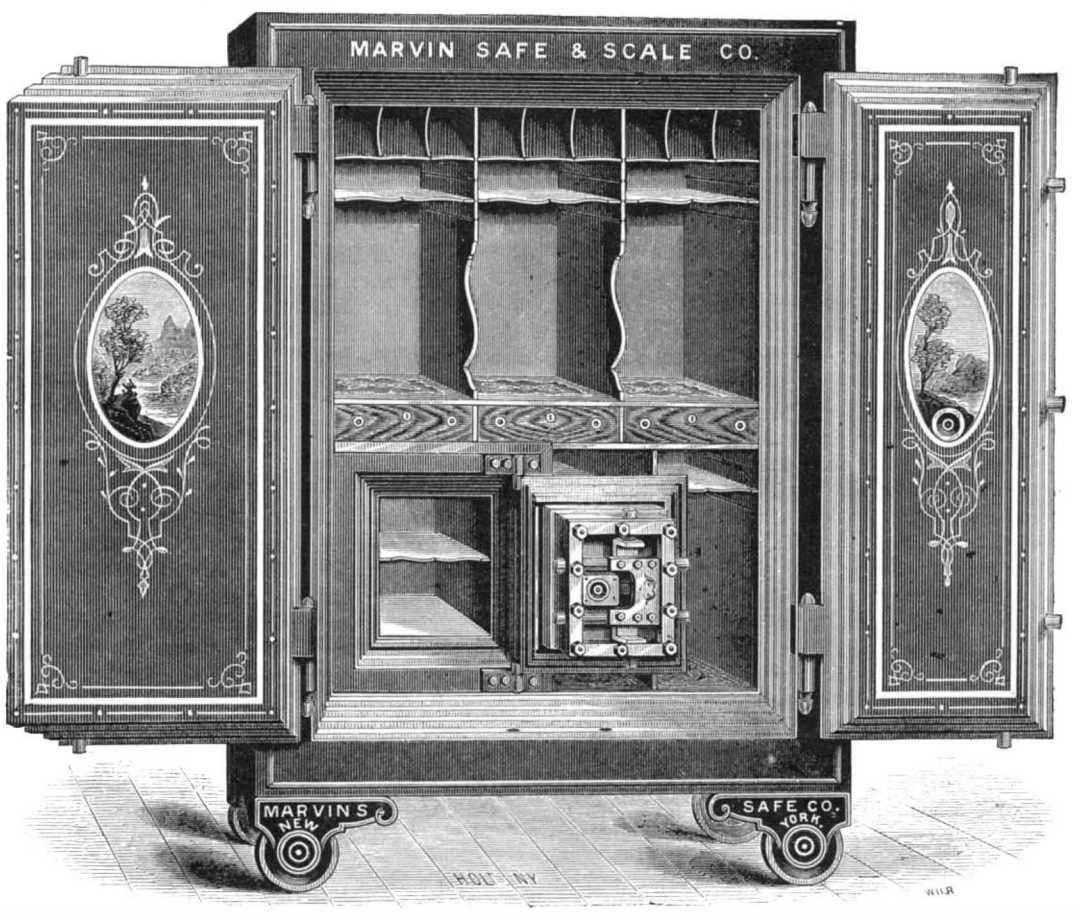


sanctioned the organization of a distinct torpedo service, and two depots and instructional schools are to be formed.

FOLDING-DOOR FIREPROOF SAFE.

The engraving represents a folding-door fireproof safe, with bankers' chest, and is similar to one recently placed in the extensive office of the SCIENTIFIC AMERICAN, being an additional one to others there of the largest size by the same makers. There are few documents more valuable than those pertaining to patents, patent records and cases. Their preservation and security are of the utmost importance to both solicitors and clients, and we may be pardoned for seeming egotism if we say that in the selection of this safe the best security against fire was taken into consideration.

Safes constructed after the manner represented are not only remarkable for the great strength obtained by a disposition of steel and iron plates, but more particularly for the means employed to render them fireproof. The filling between the plates, or safe lining, consists of alum and dry plaster. By chemical analysis it is found that alum contains over fifty per cent of water of crystallization; this water is given off into steam when subjected to 212° Fah. The moisture is absorbed by the plaster of Paris, setting the same into a hard wall. Experiments prove that the length-of time necessary to evaporate a given quantity of water into steam, as compared to an equal quantity of alum, is as one is to eight, or that alum-filling (water in crystallization) will resist heat eight times longer than any filling containing water in suspension or in liquid. The association of alum with plaster is such that the atmosphere cannot evaporate the water, and it is held subject only to heat, and that only can cause it to change into liquid form. The alum is distributed in small lumps all through the calcined plaster, and in such combination is packed tightly between the outer and inner cases of iron. With safes filled in this manner and with these ingredients there can be no deterioration. They remain fireproof for any number of years, or, in fact, until subjected to withstand a test, be that period sooner or later.



FOLDING-DOOR FIREPROOF SAFE.

Another feature that should receive attention is that this filling being a steam generator, the iron of the door casing cannot become a conductor of heat in case of fire, as the steam impinges upon the iron and keeps the temperature reduced. The filling being perfectly dry (rendering rust and dampness impossible) is of immense advantage. Messrs. Marvin & Co. have had many years' experience in the construction of safes, and have succeeded admirably in the practical application of principles essential to safety and security.

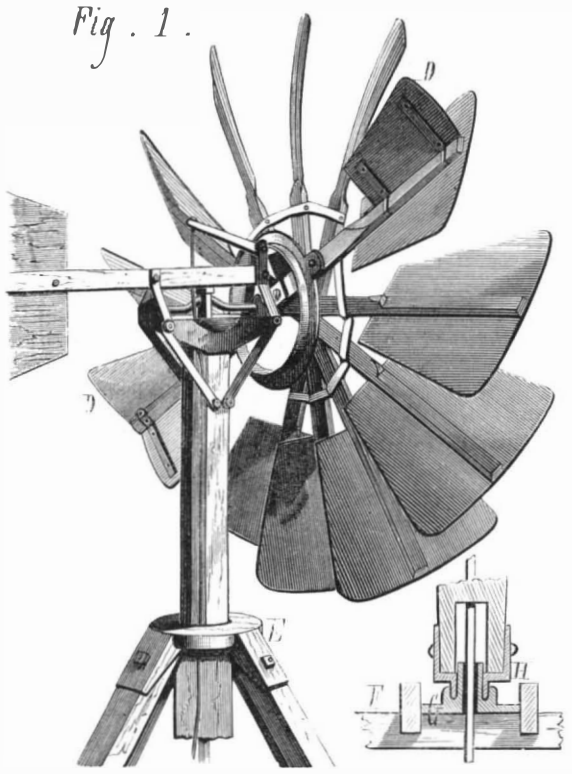
Where these safes have been subjected to severe tests, as in the case of the Chicago and Boston conflagrations, in the Bond street and the recent Barclay street fires, in this city, besides many others, they have proved to be absolutely fireproof. The warerooms of the manufacturers are at 265 Broadway, New York, and 627 Chestnut street, Philadelphia. Their celebrated "Centennial Safe," which contains a great number of memorial articles, portraits of celebrities, etc., and which is not to be opened until 1976, is now under the rotunda of the Capitol at Washington.

© 1878 SCIENTIFIC AMERICAN, INC

SMITH'S IMPROVED WINDMILL.

The novel windmill represented in the annexed engraving is, from its simple construction and capability of self-adjustment, according to the strength of the wind, excellently suited for raising water for cattle, supplying water to houses, driving churns and other agricultural machinery, or to perform a number of the various duties for which a cheap and light motor may be required. The new features to which attention is directed are the mode of connecting the arms bearing the sails, so that an excess of wind tends to fold up the latter; a brake wheel whereby the motion may be retarded, and an arrangement of a hollow revolving standard, which is held vertically and is free to be acted upon by the slightest change in the direction of the wind.

Fig. 1.



SMITH'S WINDMILL—WINGS EXPANDED.

Fig. 1 shows the wings expanded and also a sectional view of the revolving standard. Fig. 2 exhibits the wings closed. In the latter figure the outer arm, A, alone is connected rigidly to the shaft, the other arms being free to revolve thereon. The sails, however, near their extremities are connected by leather straps which allow the wheel to spread out only to its full size. The rear end of the shaft has a crank arm, and this communicates with the pump rod. On the rear of the rear arm the brake wheel, B, is secured, in contact with which is the pivoted brake, C, governed by a rod leading down the standard which supports the mill. The tail board serves in the ordinary manner to cause the wheel to turn in whichever direction the wind may be blowing. When the wheel begins to revolve, and power is thus applied to the crank arm, the front arm, A, being rigidly fixed to the shaft, is retarded. The other arms, however, are free to spread out and complete the wheel, transmitting all their power through the straps to the front arm, A.

In order automatically to govern the speed in case of storms, the check wing, D, is applied to a sail of the rear arm. This wing is slightly held by a spring, and opens out when the wheel is in high motion, so far as to form a plane at right angles with the sail proper, thus retarding the movement sufficiently to fold the wheel but not to stop the same. To obtain very slow motions the brake is employed as already indicated. A weight on the end of the brake rod may be employed to hold the wheel when the latter is not required to revolve.

Referring to Fig. 1, the vane is attached to a cross head on the standard, and suitable bearings are provided for the crank shaft to which the pitman is attached. This pitman passes down through the hollow of the standard to the pump rod. A frame composed of four angular legs is attached to arms in the cap, E. Near the lower end of the legs is placed a cross piece, F, on which the lower end of the standard rests (see sectional view). In the center of this cross piece is attached a metal plate, G, provided with a tube in the center, through which the pitman passes. On the lower end of the standard is attached a metal plate, H, provided with upturned flanges and arranged to fit over the tube plate, G, and rest thereon. Any wind acting on the vane causes the standard to turn in the proper direction to keep the wheel always in the right position.

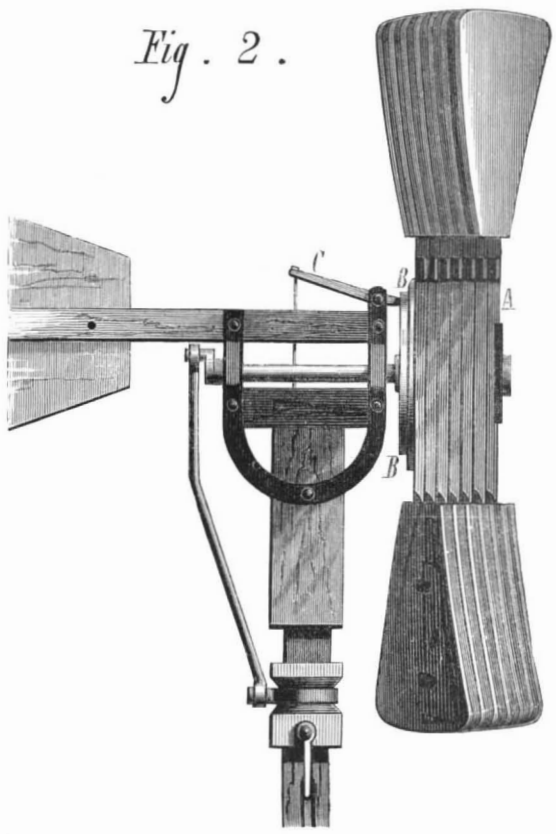
The inventor states that this windmill has been thoroughly tested with uniformly successful results. Patented May 5, 1874, and December 11, 1877. For further information relative to sale of rights, etc., address the inventor, Mr. E. S. Smith, Good Hope, McDonough county, Ill.

A NEW DIGGING MACHINE.

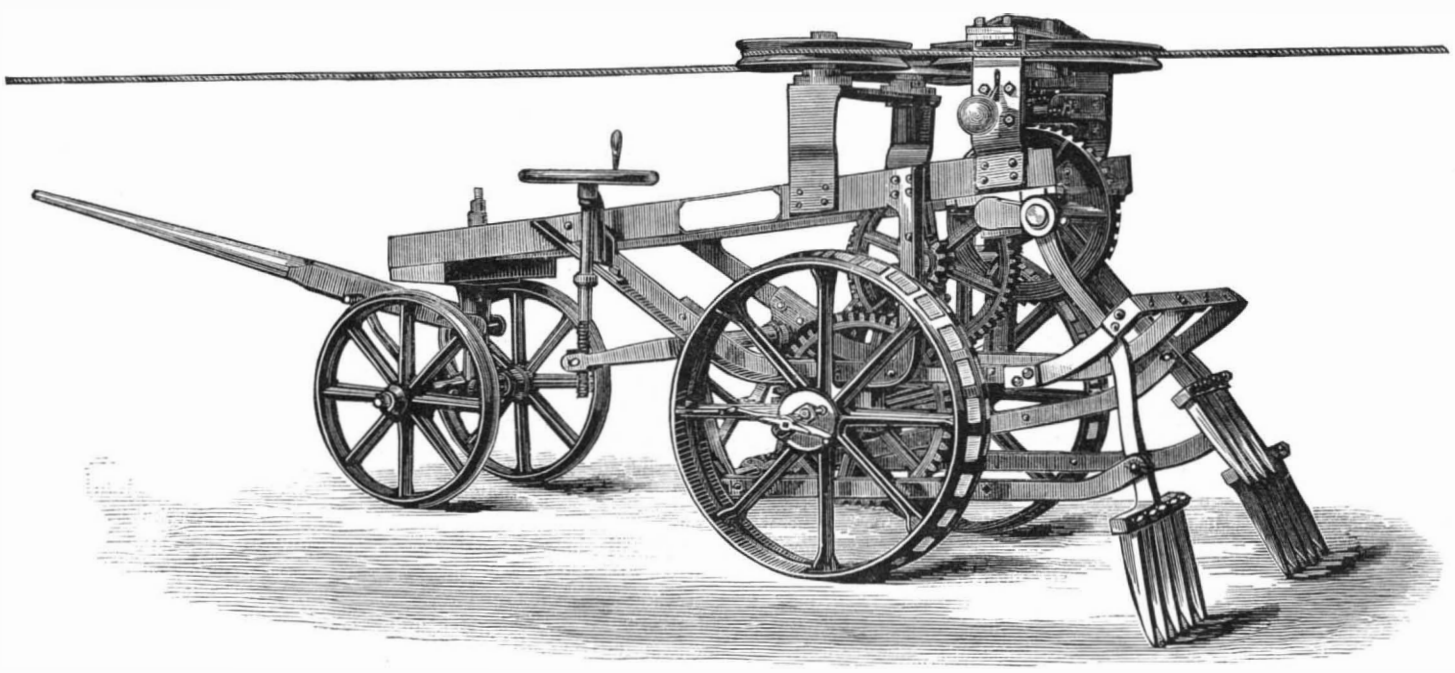
The digging machine illustrated is the invention of Mr. J. H. Knight, of Farnham, Surrey, England, and is the latest production of this engineer. The illustration, which we copy from *Iron*, will materially assist the reader in following our description. The angle iron frame, of the form shown, is supported in front by the fore carriage, which swivels on a pivot, and is provided with a pole for steering; the wheels have a central flange cast on them for giving a good grip on the ground. The hind axle is carried by bearings bolted under the frame. The land wheels, which are dished and roughened for greater adhesion, run loose on the axle, until made fast to it by clutches, which are independent for each wheel, so as to facilitate the work of turning round a corner. The clutch is keyed on the axle, and, on the screw being turned, is forced on the boss of the wheel, thus making the latter revolve with the axle. Carried by brackets on the top of the frame are three pulleys revolving freely in a horizontal plane. These pulleys are made to revolve by a high-speed rope, preferably of hemp, driven by a portable engine, which does not require to be reversed for running in a contrary direction. On the lower end of the vertical shaft of the central or driving pulley is keyed a spur pinion which communicates the motion, at a speed reduced to about one-third, to the spur wheel keyed on the crank shaft which actuates the digging forks. This shaft is cranked in the center, and has also two other cranks at its ends, all three forming an angle of 120° with each other. The shaft thus gives an oscillating motion to three wrought iron connecting rods terminating in cross ends. Into these ends are fitted separately the tines of steeled iron forming the fork, each having a shoulder and being secured by a set screw. The connecting rods are guided by segments attached to the lower part of the frame, for keeping them in a line parallel with the travel of the machine, and they are jointed near their cross ends to radius rods, which, being keyed on to a kind of weigh shaft working in bearings near the front of the machine, are capable of being raised or lowered, according to the depth of spit required. This action is effected by means of a hand wheel, worm, and lever, by which also the forks may be raised quite clear of the ground, while the machine is traveling but not digging. For cutting off the motion altogether, a friction clutch, worked by a lever and ball from the outside, is provided just below the driving pulley. The traveling motion is communicated by a spur pinion on the crank shaft, working through a train of spur wheels and pinions gearing into a pinion fast on the axle, thus reducing the speed of the latter to one revolution for every twenty-two of the former. Reference to the illustration will show how the power is applied. The motion is transmitted to the machine by an endless rope, about three quarters of an inch in diameter, from an eight horse-power agricultural engine, moored as in steam plowing. The rope passes round a pulley on the driving shaft of the engine, and also round the pulley of an anchor carriage for securing the necessary tension, and is then led to the machine direct, being supported in a straight line by simple "porters," as they are called, or pulleys carried on a movable stand, and the direction being changed by "angle porters" at the corners of the gradually increasing rectangle described by the rope. By passing round the driving pulley, the rope causes the machine to propel itself by means of the land or bearing wheels. The tail rope is merely carried on porters back to the engine, the tension being kept up by the anchor carriage, which is in charge of the engine driver.

The speed of the rope is about 3,000 feet a minute, and that of the machine about 100 feet. The forks are driven into the ground one after the other, sending the earth flying out behind, with such speed that some minutes are required before the eye can follow their movement. It is natural to suppose that the forks would be simply inserted in the ground, and taken out, without turning over the earth; but this is not the case. The cranks give the vertical motion to the forks, and as the latter are pivoted, near their lower end, to the connecting rods, a leverage is exerted at this point for turning over the soil. The effect of this action is intensified, owing to the fact that from the time the points of the forks enter the ground to their leaving it, the machine has progressed a certain distance.

Fig. 2.



SMITH'S WINDMILL—WINGS CLOSED.



KNIGHT'S IMPROVED DIGGING MACHINE.

New Inventions.

The improvements in a new Box Iron devised by M. Jean G. Ruger, of Paris, France, consist in providing one end of the iron with a partition plate, so arranged as to form an air inlet passage; and second, in a movable chimney for the escape of the gaseous products of combustion, the chimney being adjustable to discharge the gases in the direction least liable to interfere with the operator or to injure the material.

A Sled Propeller has been patented by Mr. Daniel Williams, of West Philadelphia, Pa. To the forward end of a flexible bar projecting from an ordinary sled is pivoted a third runner, to which is attached a cross bar, by which the driver can steer the sled. On both sides of the sled there are placed levers which work dogs intended to take hold of the snow and thus assist in steering.

Mr. Lars P. Bergstrom of Rock Island, Ill., has invented an improved Winding Alarm for Clocks. It is attached to eight day and thirty day clocks, run by weights, to cause them to give an alarm when they are about to run down.

Mr. Wm. T. Urie, of Warrensburgh, Johnson Co., Mo., has devised a new Spark Arrester. In the smoke stack is arranged a curved, downwardly projecting, annular flange, which deflects the sparks downwardly and to the center. Below this is arranged a centrally located two-part hopper, which, in combination with the deflecting flange, causes the

© 1878 SCIENTIFIC AMERICAN, INC

sparks to be first diverted outwardly, then deflected downwardly and centrally against the inner walls of the upper furnace, whence they fall into the lower closed funnel, and are drawn (by a current induced by the force of the next blast) up between the inner walls of the lower furnace and the outer walls of the upper funnel into the main current, in which they circulate.

An improvement in that class of Curtain Fixtures in which the rolling curtains are adapted for lowering from the top has been devised by Mr. William W. Pickford, of East Palestine, Ohio. In this improved curtain fixture the holders and clamps for the curtain cords are arranged in a novel and ingenious manner.

A Tail Piece for Guitars has been invented by Mr. Jacob Abraham, of Silver City, New Mexico, which is made of metal or other suitable material and is combined with a flanged foot rest, the object being to effect the vibration and at the same time prevent cutting or scratching the box of the guitar.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

As a result of a recent competitive examination the following promotions have been made in the corps of assistant examiners in the Patent Office: To be first assistant examiners—R. L. B. Packard, of Maine; L. B Wynne, of the District of Columbia; S. Brashears, of Maryland; and F. S. Williams, of New York. To be second assistant examiners—F. B. Pierce, of New York; H. S. Underwood, of Mississippi; George P. Fishee, of Delaware; and R. Mason, of Tennessee.

PATENT OFFICE MATTERS.

The Commissioner of Patents has recently sent a circular to the examining corps which is causing some little excitement among the attorneys practicing before the office.

The circular requires that the examiners shall exercise greater care in cases before them to see that the state of the art prior to the applicant's invention is stated specifically in the specification, and where it is an improvement on a previously patented article, it must be so stated, in order that any one reading the patent, even if unskilled in patent matters, would see not only what is claimed, but would see set forth clearly the exact state of the art upon which the invention was based. The fact that, owing to the great number of patents granted with claims of a trivial nature, our patent system has grown into considerable disrepute, the Commissioner thinks is sufficient reason for greater care in this respect.

Many of the attorneys are of the opinion that the ideas set forth in the Commissioner's circular cannot be carried out, as it would be impossible to set forth the state of the art in many cases without making the specification of an inordinate length. It is probable, however, that the office will not require such a full statement as to cumber up the specification in this manner, but only when it can be clearly seen that the alleged invention is only a slight improvement on a previous machine or device that it shall be so stated, instead of having the specification so worded as to convey the idea to unskilled readers that the patent covers the whole machine or device shown therein, when it really covers only some little point that is of very little value to any one and only useful as a means of obtaining a patent. There is no doubt that many worthy people have been badly swindled through purchasing "rights" in patents of this character, and if such swindles can be avoided it will certainly help to sustain our patent system against the outcry now being made against it.

In the application for the reissue of the patent No. 19,786, granted to John L. Mason March 30, 1858, and extended in 1872, an appeal having been taken from the Board of Appeals, who had rejected the first and fourth claims, the Commissioner affirmed the decision on the ground that the first claim, which was for "a screw chuck or former for caps of sheet metal provided with a rounded thread," was met by the reference cited, which showed a V-shaped thread only, as it required but the smallest amount of intelligence to enable one to take off the cutting edge formed by the apex of the thread so as to make it round, when it was found that it cut the metal of the cap during the process of spinning. With regard to the fourth claim, which was for a screw chuck or former made tapering toward its outer end, the Commissioner decided that as screw chucks were old and tapering formers were also old, there was nothing patentable in combining the two, as their functions were in no wise modified by the combination.

In the interference case of Adelbert Gates (deceased) *vs.* Hiram Rowe, motion having been made that the preliminary statement be amended, and it appearing that said statement was made by the brother of the inventor, acting as administrator, who, since filing the statement, had discovered that one E. P. Bennett, who had recently returned home after an absence of several months, had knowledge that the invention was of earlier date than that given in the statement, and that it was unknown by the administrator at the time of making the statement that said Bennett knew anything of the invention, the Commissioner decided that the statement ought to be amended, especially in view of the fact that no testimony had been taken in behalf of Gates.

In the interference case of Stearns *vs.* Wood, in which the parties occupied the relative positions of employer and workman, the Assistant Commissioner affirmed the decision of the Board of Appeals to the effect that, although the workman may have been the first to suggest and describe a certain portion of the device in controversy, yet, in view of the decision of the Supreme Court in the case of the Union Paper Collar Company *vs.* Van Deusen *et al.*, 7 O. G., p. 919, that a person having made a new invention and employing others to carry it out, if the employed persons make discoveries auxilliary to the plan and preconceived design of the employer, the suggested improvements are in general to be regarded as the property of the latter, and may be embodied in his patent as part of his invention, the priority would have to be awarded to the employer.

An appeal having been taken in the case of Chas. McEvoy for the registration of the word "Hibernicon" as a trade mark, to be used in connection with an exhibition, against the decision of the examiner of trade marks, the Assistant Commissioner decided that the trade marks which the law contemplated referred solely to marks to be used on articles of trade, and that the purpose of a trade mark was to denote the origin or ownership of the articles of trade to which it was attached, and that therefore a trade mark connected with an amusement was something not contemplated by the law, and the examiner's decision was therefore affirmed.

The Commissioner in Kilmer's interference case has again decided, as on a former occasion, reported some weeks ago, that he would not allow a preliminary statement to be amended where the testimony of the opposite party had been taken.

In the case of the application of Getzendanner and Margreardt, which had been required to be divided by the examiner, because one of the devices related to a harness collar having a peculiar contrivance for automatically connecting the two parts of the collar at the lower ends, and the other device consisted of a suspending apparatus for holding the harness up until the horse should be placed thereunder, when the harness was released and dropped on the horse, the Commissioner decided that in view of the fact that each of the devices in question operated independently of the other, that the harness would act just as well without the suspending device, and that the latter could be used to hold up a collar having a totally different fastening, or any other article, the case ought to be divided, as a strict attention to the maintaining of the classification of the office was necessary both for the good of the public and for the convenience of the office in making searches.

The St. Louis Beef Canning Company having applied for a trade mark for canned meats in which the figure of an ox was the symbol desired to be registered, the examiner of trade marks refused it on the ground that it was descriptive; the Assistant Commissioner reversed the decision on the ground that as the trade mark was designed to be applied to all kinds of meat, it could hardly be considered as descriptive, certainly not to all other meats except beef, and as to the latter the name of the figure represented was different from the commercial name of the article contained within. In this respect the use of a tomato on canned tomatoes or an ear of corn on canned corn differed essentially, and as these considerations give rise at least to a doubt, it should be given in favor of the applicant.

A recent visit to the burned district shows that considerable progress is being made with the work of restoring the partially destroyed models. About 140 hands are employed at present, and the interior of the north hall has the appearance of a large machine shop. Long rows of benches furnished with lathes and vises extend from one end to the other, and on which a variety of work is carried on. Large numbers of models are being picked out which when cleaned and painted look as good as new, and many of them I have no doubt look better than before the fire.

The first number of the *Patent Office Gazette* for 1878 has just been issued, and is a great improvement on that of last year. The form of the page has been changed from three to two columns, which allows of a much better display of the engravings, as under the old style the engravings had to be so much cut down as to render them almost unintelligible in many cases.

It has been the practice with many persons desiring to begin the business of a patent agent to get a position in the Patent Office in some way, and then, as soon as they had a slight knowledge of the practice of the office, resigning on purpose to open a patent agency. In this manner they got Uncle Sam to pay them while they were educating themselves for their own private business. This, however, is not the worst of the matter, for some of them took lists of all partially rejected cases they could find and then wrote to the inventors, boasting of the facilities that their connection with the Patent Office had given them, and stating that unless they were employed, the cases referred to would finally be rejected, and in this manner took a large amount of business out of the hands of experienced practitioners. Worse than this, one or two have been credited, or rather discredited, with rejecting cases previous to their leaving the office, so that they might have a chance to get them passed afterward, when acting as agents. To prevent these practices a bill has been brought into the House by Mr. Douglass, which provides that it shall be unlawful for any officer, clerk or employé of the Patent Office to act as counsel, agent or attorney in the prosecution of applications for letters patent, or of any interest in letters patent, or be interested, directly or indirectly, in any firm established for prosecuting patent applications, or of any interest in letters patent, nor by any manner or means to aid in the prosecution of such patent applications within two years next after he shall have ceased to be such officer, clerk or employé; that any person in the service of the United States violating the provisions of this act by knowingly recognizing any such ex-officer, clerk or employé in any application for letters patent or any interest in letters patent as counsel, attorney or agent, shall be, *ipso facto*, discharged from the service of the United States; and the District Attorney shall proceed by writ of quo warranto, against any person in the United States service who shall violate the provisions of this act, and shall prosecute the same to the removal of such person from office. Bills similar to this have been introduced into Congress several times before, but have never passed, and it is doubted if Congress has power to pass such a law under the Constitution.

A CHANCE FOR INVENTORS.

I find the following in one of our dailies:

"The Post Office Department is considering a large number of petitions from persons in all sections of the country who desire to transmit samples of flour through the mails at third class rates. Heretofore the principal difficulty in the way of compliance with the petitions is the objectionable nature of the material sought to be transmitted. Under the postal regulations, as now existing, articles transmitted in the mails must be so put up as to enable postmasters to ascertain the contents without damaging the wrappers, and flour cannot be so inclosed without damaging the other contents of mail pouches. It is believed that, could this difficulty be overcome, a very considerable revenue might be derived to the department from the increased business that would be brought thereto by the large dealers in the commodity referred to. The matter is receiving careful consideration, and if any way can be devised to overcome the obstacle, a reasonable latitude of construction will be given to the law governing the transmission of third class matter through the mails."

This seems to be a good chance for inventors to get up some new style of envelope or bag for mailing purposes, to be used for samples of flour, sugar, tea, and many other articles in the grocery line, that will not spill the contents among the other mail matter and yet allow of a ready examination being made by the Post Office authorities without damaging the covering.

ANOTHER RAID ON "DESERT" LANDS.

The Commissioner of the General Land Office has under consideration a bill referred to him by the House Committee on Public Lands, to authorize O. W. Wozencraft and his associates to irrigate the "desert" west of Fort Yuma, in California, which is said to contain about 3,500,000 acres. The bill provides that the company shall be allowed ten years to supply this tract with water from the Colorado river by aqueducts, ditches, or canals sufficient for the purposes of travel and emigration over the said desert, and also for irrigation. The land so irrigated at the end of ten years is to be conveyed in fee simple to Wozencraft and his associates at such price as shall be fixed by a commission to be appointed by the Secretary of the Interior. This tract is supposed to have been at some remote period the bed of a sea or a part of the Gulf of California, and is represented as being about 200 feet below the Colorado, from which it is proposed to take the water for irrigation, etc. In order to avoid the surrounding high lands, the water will be taken round through the upper portion of the Mexican State of Sonora, but the distance the water supply has to be taken is not mentioned in the bill.

It would appear, however, from the official surveys in the Land Office that this said-to-be useless waste or "desert" of 3,500,000 acres is already capable of growing tolerably abundant vegetation. It is stated therein that when the Colorado overflows into the New river, that sinuates through the so-called desert, leaving a little water in the hollow places, "weeds" spring up which in thirty days grow to a height of 12 feet and a diameter of 14 inches. The mosquito bean also flourishes here. This bean grows on trees, not vines, and supplies the nomads of that region with abundant shade and cheap food, and it is stated that a single tree feasted twenty mules for three consecutive nights, without apparently making a diminution of the crop! If land that is so prolific in vegetation as this is called a "desert," what must fertile regions be?

THE NATIONAL OBSERVATORY.

A bill has been introduced into the Senate and debated to some extent, looking to the removal of the Observatory to some position which shall possess the advantages of healthfulness, clearness of atmosphere, and convenience of access, which the present location lacks, as the river fogs obscure the sky, rendering observations at many times impossible; the malaria sickens the officials; the hill on which it is built has been so cut into in laying out streets surrounding it that access is difficult, and the traffic in the neighborhood affects the instruments. In addition to this the buildings are so old as to be falling to pieces, and are not worth repairing. These old buildings, which the recent "Fire Commission" stated were regular tinder boxes, contain a valuable library, priceless records, and the finest telescope in the world; and the Senate committee therefore agreed to report a bill appropriating $300,000 for the purpose of erecting a new building, which it is believed will be put up on the hills north of the city. It is intended to purchase about thirty acres of ground, so that the Observatory will not be interfered with by the smoke of surrounding factories or dwellings.

Washington, D. C. OCCASIONAL.

© 1878 SCIENTIFIC AMERICAN, INC

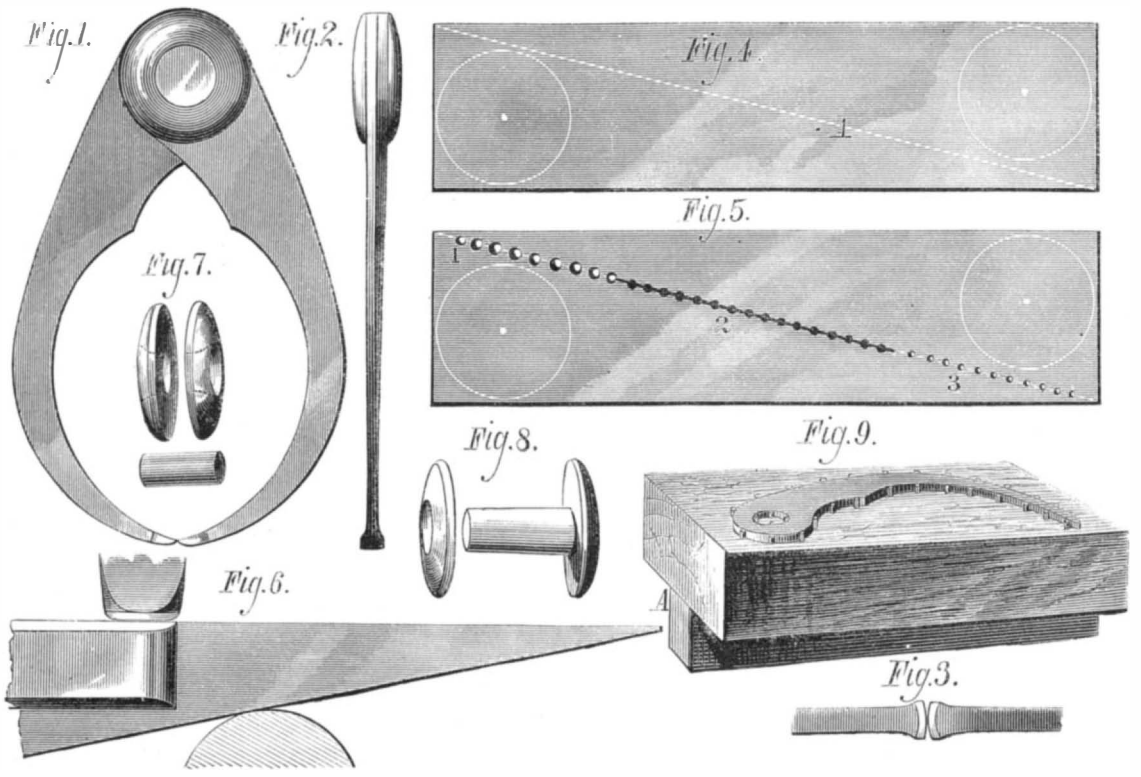
MAKING CALLIPERS.

Outside callipers for measuring external diameters are made in a great many shapes and forms, but may be classified as gauging callipers having measuring lines attached, those with simple legs and a set screw, those with a spring and an opening and closing screw, those with plain legs, and those combined with inside callipers. The latter may be termed the calliper proper in contradistinction to calliper gauges, such as the Vernier. Plain leg callipers occupy a field entirely their own, their use being as much directed to making a fit of one piece to another irrespective of the measure of the pieces as to actual diametrical rule measurement. Their shape enables them to pass over and measure diameters too large for the use of gauge callipers, the jaws of which cannot be kept true or parallel one with the other if they extend far out from the staff to which they fit. Plain leg callipers are, for all diameters less than about a foot, better without a set screw, because the thread of the latter bulges by wear; and, furthermore, the set screw wears into the radial segment upon which it fastens, and, as a result, when tightened it is apt to move the leg, destroying the adjustment. Then the screw wears smaller and the tapped hole larger, so that in time the thread strips and the tool becomes useless until repaired, and even then is never so efficient as at first. Spring callipers are very easily adjusted, but have several disadvantages. First the nut wears loose upon the thread, and is then very apt to slack back; then the nut will turn very easily if it happens to touch anything. Again, as usually made, the points are too thin and badly formed. Furthermore, the spring is apt in time to lose some of its elasticity, so that when opened to the full capacity the legs will be loose, in which case it is impossible to measure large diameters with exactitude. The plain leg callipers are open to none of these objections, which may justly be termed attempted refinements out of place for such work as this class of tool is intended for.

The considerations determining the proper proportions and shape of a pair of plain leg outside callipers are: A joint that shall move evenly and shall not get any looser by wear. A rivet that shall not wear so as to give that lost motion or loose spot commonly termed, with callipers as with jackknives, "the headache." Points of such a shape that the nearest or measuring spot shall remain in the same spot, no matter what size they may be set to. And legs sufficiently strong not to spring in rough calliper-ing, and of a shape to be sightly and at the same time designed to take in as large a diameter as is proper in proportion to the length of the leg. Taking all these things into consideration, we arrive at the form shown in Fig. 1. It will be seen from Fig. 3, which is a view of the points on the outside, that they are slightly rounded: this is done to make the point of contact in the middle, so that it shall always be correct to place the point of the inside callipers there.

The best method of making these callipers is as follows: The material should be good cast steel of an even thickness, and therefore (unless for very large ones) saw blade will answer the purpose. It should be well softened by being made to a low red heat and buried in fine cinder ashes or lime, and allowed to cool there. The proper size of this piece of steel is such as shown in Fig. 4, the width being sufficiently greater than the size of the calliper washer, to allow room for a chisel cut and leave a little to file off in truing up the joint. The length should be somewhat more than that required to make the legs, because a piece will require to be cut off the narrow end to give substance enough for the points. The size of the washer should be shown at each end of the steel, as marked in the figure; the center of the washer should be centerpunch-marked as shown, and the line, A, should then be drawn to set off the two legs. The steel is then severed along the line, A, thus getting out the two rough legs. When shears are not at hand, or when it is not designed to use them for this purpose, the legs may be got out as follows: Take a piece of saw blade and soften it as before, but let its width be greater, as shown in Fig. 5. Draw the line, A, as before, and the piece will be ready to divide to form the two legs. This dividing, however, is a delicate operation, because the part on the narrower or weaker side of the line, A, is so apt to split or crack. Three methods of dividing may be pursued: First, we may drill small holes along the line, A, and cut between the holes with a chisel. The objection to this is that the blade is sometimes very hard to drill. Secondly, we may make centerpunch marks along the line, A, and then cut along the line with a chisel; and, thirdly, we may drill a few holes at each end, and cut the middle with the centerpunch and chisel. Each of these processes is shown in Fig. 5, the drilling at 1, the centerpunching and chiseling at 2, and the drilling, at the end only, at 3. The entire drilling is the safest, and the centerpunching the most hazardous, but it can be accomplished if the centerpunching is done lightly and gone over several times, with the chisel applied between each time, and the latter will be much the quickest.

The hole is next drilled for the rivet, care being taken to make it about $\frac{1}{88}$ inch smaller than the proper size, because the drill will not make a sufficiently true and parallel hole, and the latter must be reamed or trued out; and again because the legs have to go into the fire to be bent, and hence the holes may become damaged. There is another consideration, however, in determining the size to drill this hole, which is that the two legs require to be riveted together to bend them, and it is as well to drill the hole to suit the piece of metal intended to be used for this temporary rivet, which should be of brass or copper, so as to drive out easily after the bending is done. During the bending process the points should be thickened, as shown in Figs. 1, 2, and 3, care being taken not to twist them in the process. If other than a blacksmith does the bending, the following instructions are pertinent: Heat the steel slowly and turn it over and over in the fire so that the points may not get burned before the wider parts are sufficiently heated. Let the fire be a clean one, that is, with no gaseous or blazing coal about it, or the coal will stick to the sides of the callipers, and they will get cool while being cleaned of adhering coal after being taken from the fire. Begin the bending from the thick end, carrying it forward by degrees. Strike light but rapidly succeeding blows, placing the steel upon the anvil as shown in Fig. 6, in which the round point of the anvil is shown in section: the upper edge of the callipers is represented level with the upper edge of the tongs, and a hammer is shown resting thereon. The object of the hammer upon the tongs is to prevent the callipers from moving in or flying out from the tongs, and to increase the effect of the blows delivered upon the steel to bend it, thus greatly accelerating as well as facilitating the bending process.



MANUFACTURE OF CALLIPERS.

The bending completed, and the points being thickened, the edges of the legs are trimmed upon an emery wheel or with a file, using the latter lengthwise of the edges if a new one, or crosswise if an old one. A full $\frac{1}{32}$ inch may be left to trim off after the callipers are put together. The temporary rivet may next be driven out, first, however, gripping the legs firmly and near to the rivet end with a hand vise, putting a piece of sheet brass between each jaw of the hand vise and the steel; otherwise the teeth of the latter will mark the steel, entailing a great deal of extra labor to file the marks out. The rivet hole is then reamed out to the required size, the two legs being held together by the hand vise to render the reaming more steady and true by making the hole longer when the two are together.

The next operation is to turn the rivet and washers. It is a very common practice to turn two separate washers and a rivet, as shown in Fig. 7. On account, however, of the small amount of bearing in the washer holes, such washers are apt to rivet up out of fair, one with the other making an unsightly joint and causing them to be out of round when the edges of the joint are filed up. A better plan is to turn a pin and washer, as shown in Fig. 8, taking care to make the diameters of the two exactly equal and the flat faces of each quite level. The pin should be turned about $\frac{1}{64}$ inch taper, the small end being made a neat fit to the holes in the calliper legs, and should be made of cast steel properly annealed. When finished, the head of the pin should be gripped by a pair of lead clamps in the vise, the end being left protruding so that the legs can be put upon it and revolved back and forth with a good supply of oil and under hard pressure, so that the pin will be forced a good and rather tight fit into the holes. This process will also smooth out the holes and condense the metal around both the holes and the pin. It is well to leave the pin to fit about one half as tight as the finished joint requires to be. The washer should be countersunk about three quarters of the way through the hole, the latter being left a close working fit to the pin. The amount of taper of the countersink on the washer should be about as shown by the dotted lines in Fig. 7.

The best method of holding the legs during the filing is to fasten them upon the planed flat surface of a piece of soft wood, as shown in Fig. 9, in which the dots around the edges of the leg show the brads. If the piece of wood is too wide to go between the jaws of the vise, a gripping strip may be nailed beneath, as shown in the edge view in Fig. 9 at A.

The legs should be rough filed, second-cut filed, and smooth filed before being draw filed, care being used to keep the files clean, so as to avoid scratches. During this filing, however, the pin shown in Fig. 8 should be tried in the hole to see if the head comes fair down upon the face; thus the pin forms a guide and test in facing up the joint of the leg, and this is one of its advantages over the two washer plan. After carefully draw filing and polishing the sides of the legs the fitting of the joint is finished as follows: Place the two legs upon the pin in their proper position, and then put the washer into its place. Then behind the washer place another temporary one that will protrude beyond the end of the pin; then grip the whole tightly between a pair of lead clamps or pieces of thick leather in the vise; this will bring all parts of the joint home. Take hold of one leg in each hand and move them backward and forward as far as the vise will let them go, repeating the operation about a dozen times or more. This will mark the high spots upon the legs, which may then be taken apart again and have the bright parts removed by a scraper. It is also well to place the flat face of the washer upon a smooth file and rub it backward and forward under pressure, which will tend to correct any defect in its flatness. When the faces of the joint bear all over, it may be put together with oil and placed in the vise as before. Work it well back and forth, take it apart again and cut off the rivet to the required length, taking care very slightly to recess the end to assist the riveting. The whole joint should then be wiped quite clean, freely oiled, and put together ready to rivet. The head of the pin should be rested upon a block of lead, so that it will not get damaged. The riveting should be done with a small light ball pened hammer, the blows being delivered very lightly and evenly all round the edge. As the riveting continues it is necessary to move the legs occasionally to see how the tightening proceeds, and when the legs are sufficiently tight, one of them may be gripped between pieces of leather in the vise, while the other is well worked and lubricated with oil. Then the riveted end should be filed off to very nearly its proper height and shape, and the joint well worked back and forth and round and round in the hand until it gets quite warm, when it may be cooled in water and tried for tightness. If too tight, it may be either worked until easy or the riveted end of the pin may be tapped with a hammer slightly to loosen it. The riveting being completed, and the end filed smooth, the rounded part of the washer and the pin head should be draw filed with a very fine file moved in varying directions, and then the polishing may be done with emery paper.

JOSHUA ROSE.

How it is Regarded.

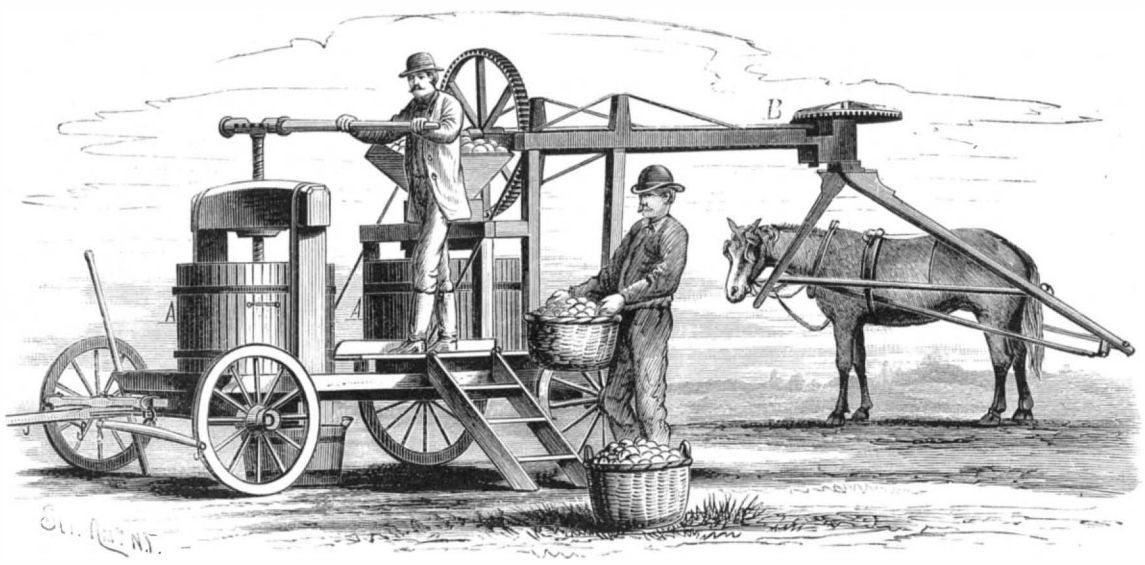
One of the best papers that come to the *Hawkeye* table is the SCIENTIFIC AMERICAN. It is unquestionably head and shoulders above any other science journal in the world. We say this because while it is truly scientific and profound, it is also readable and popular with the great masses of people who are not scientists, and make no pretensions to techniques. Hence a great mass of really valuable information is widely disseminated among the people, including not a little of really practical knowledge for everyday life. This valuable characteristic of the SCIENTIFIC AMERICAN is supplemented by almost the entire press of the United States, which copiously draws upon its rich stores for useful reading matter. Its illustrations are very fine, its editorials scholarly, and its various departments replete with instructive reading. The answers to correspondents are extremely popular and valuable. There is hardly a profession in life but that would be benefited by making the SCIENTIFIC AMERICAN a part of its stated reading.—*Burlington (Iowa) Hawkeye.*

© 1878 SCIENTIFIC AMERICAN, INC

IMPROVED PORTABLE CIDER MILL.

We illustrate herewith a new horse power cider mill which is readily moved from farm to farm, and by which, it is claimed, entire crops of apples may be ground and pressed quickly and economically.

Upon a platform placed on wheels and adapted to be drawn by horses are longitudinal track rails on which are two curbs, A. These curbs have grooved bottoms so that they may be readily moved on the rails from one end of the platform to the other. Above one curb is placed a cross-beam for the screw of the press head, and above the other is the receiving hopper and grinding roller of the mill. A portion of the platform is inclined toward a central lateral gutter which has a spout at one side through which the cider is drawn off. Opposite the exit spout is hinged a step-ladder, which may be thrown upon the platform after use. A horizontal overhead frame extends back of the platform, and supports at the end the master wheel and shaft of a horse power, B. The horse is hitched to arms, one of which is rigidly attached to a socket of the shaft, and the other is hinged to fold up on the fixed arm after use. The arms are braced by a cross-piece and lock pin, and turn, when the horse is hitched to them, the master wheel, and thereby an intermeshing pinion and driving shaft supported on the overhead frame. A gear wheel at the opposite end of the driving shaft meshes with a pinion of the grinding cylinder and keeps the same in motion.



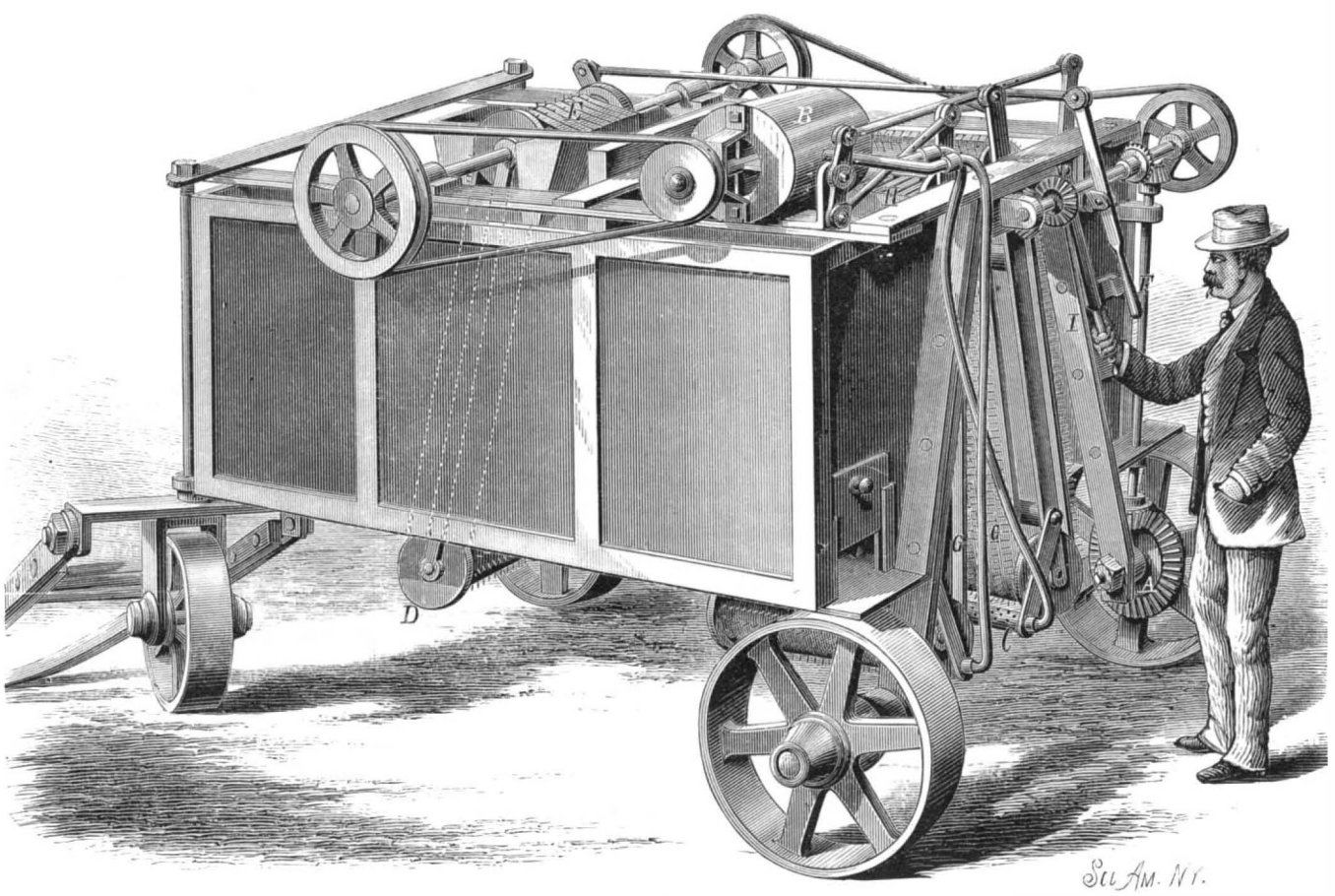
SIKES' PORTABLE CIDER MILL.

When the first curb is filled with ground fruit it is moved on the rail below the press and an empty curb is substituted beneath the grinding mill. The pomace in the first curb is then pressed and the cake is taken out, when the curb is again ready to be filled by the mill. In this way the curbs are alternately changed from mill to press, and work is continuously maintained at considerable saving of time and labor.

Patented through the Scientific American Patent Agency November 6, 1871. For further information address L. V. and S. R. Sikes, East Otto, Cattaraugus county, N.Y.

POWELL'S IMPROVED COTTON HARVESTER.

We have frequently called the attention of inventors to the need which exists for a machine for harvesting cotton, and have pointed out the saving in labor which an efficient apparatus would effect. The problem, however, is rather a difficult one, inasmuch as it involves not merely the picking of the cotton, but its gathering clean, that is, free from leaves and other trash. An ingenious device for this purpose is illustrated in the annexed engraving, and the mode in which it operates is by subjecting the bolls to a blast from the blower, which causes the light cotton to extend upward so that its filaments are easily caught in fine teeth on endless moving aprons. These last are cleared by stationary fingers, and the cotton is thus accumulated in the receptacles in the machine.



POWELL'S IMPROVED COTTON HARVESTER.

The mechanism is actuated by gearing at A, connected with one of the rear wheels. B is the blower, the blast of which is conducted downward by flexible tubes and discharged through the perforated pipes, C. The machine has an opening at the middle so that its wheels move on each side of a row of plants, and the latter in passing through said opening are stripped.

As the machine progresses the toothed belt, D, first comes in contact with the top of the plant, and the cotton caught by the teeth is carried upward until removed by the fingers, E, when it falls into the receptacle immediately below. By means of suitable lever connections by moving the handle, F, the lower roller over which the belt, D, passes may be swung up so that the action of the belt may be adjusted to plants of any height, or the belt may be lifted out of operation altogether. The plants, as the machine passes over them, are next stripped on the sides by the belts, G. The perforated blast pipes, C, direct jets of air upward along the inner surface of the aprons, so that any particles of cotton that may be detached by the action of the machine are carried upward until they are caught by the teeth. The same blast also serves to remove sand. The cotton thus collected is carried upward, removed by fingers, H, and thus removed into receptacles as before. The drums of each belt are journaled in a frame, and the gearing between those of the two rear belts is such that the movement of one frame creates a similar motion in the other, but in the opposite direction. This movement is governed by the lever, I, by operating which the lower drums are adjusted nearer together or further apart, so as to suit the sizes of the plants and to secure close picking. Horses are attached to caster wheels on the front corners of the machine, and a platform may be provided in rear for supporting the operator, Openings, one of which is shown at J, are made for emptying the cotton boxes. The machine is guided by the horse in the shafts shown. The teeth on the aprons are the same as card clothing, except that they are but three eighths of an inch in length. They are placed very close together, so as to exclude trash and leaves. The inventor informs us that this machine has been very successfully tested, and he claims that it will cause a saving of two cents a pound in cotton harvesting.

Patented October 23, 1877. For further particulars address the inventor, Mr. William J. Powell, Marshfield, Plymouth county, Mass.

The Talking Phonograph on Exhibition.

Mr. Thomas A. Edison recently exhibited his talking phonograph before the Polytechnic Association of the American Institute, in this city. This was the first public showing of the instrument, and although much yet remains to be done to make it fulfill the design of its inventor, its capabilities have already been considerably advanced beyond those which it possessed when displayed to us in this office shortly after its origination. The mechanical construction, that is, the rotating sliding cylinder, the vibratory membrane and the tin foil strip which receives the indentation and in turn transmits the pulsations to the receiving diaphragm, have not been materially modified, but by the use of reflectors Mr. Edison has succeeded in magnifying the sound so as to render the same quite audible throughout a large apartment. The scientists who assembled to hear the phonograph manifested genuine astonishment, and the instrument itself, apparently on its good behavior, did its best to strengthen the impression. It proved its capacity as a linguist by repeating sentences spoken to it in English, Dutch, German, French, Spanish, and the Hebrew. It imitated with marvelous fidelity the barking of dogs, crowing of cocks, etc., and then taking a severe cold, coughed and sneezed and wheezed, until the physicians in the audience instinctively began to write prescriptions. After the inventor had exhibited its reproduction of his remarks, his auditors wanted the machine to imitate theirs also, and for a long time the apparatus was made the recipient probably of all the different sounds that the human voice could produce or scientific ingenuity devise. It withstood the test triumphantly, and remained in modest silence while praises were lavished upon it and suggestions innumerable made as to its future uses. Another proposal was to reproduce figures of popular speakers in life size—electrotype Mr. Beecher, for instance—reproduce his speech in tin foil, put a phonograph, run by clockwork, inside of him—the statue, not the man—and stand him on a platform to repeat the new lecture on the "Wastes and Burdens of Society." Another suggestion was that public speakers might repeat their speeches to the phonograph, and then twenty-four hours later have the phonograph repeat the words to them. They could thus prevent themselves from making rash or overheated or silly remarks. An irreverent individual "didn't see but that now, with the talking phonograph and singing telephone, clergymen and choirs were out of date. The phonograph could repeat service every Sunday and run off old sermons with wonderful accuracy; while, by having enough telephones, one choir would supply music to all the churches in the city." An amendment to this was the suggestion to use only the phonograph, because it could sing as well as speak, and thus it might do the duty of both preacher and choir. An indolent listener to the foregoing wanted to know if a phonograph could not be combined with a clock so as at the proper times to remark, "7 o'clock, time to get up;" "12 o'clock, go to dinner," and so on. The audience, some of the members of which were at first rather doubtful as to the foundation for all we had said regarding Mr. Edison's invention, left well convinced as to its wonderful capabilities. Meanwhile the inventor is relaxing no efforts to improve it, and we shall be much mistaken if before many months he does not astonish us with a machine able to do much greater things than those already accomplished.

© 1878 SCIENTIFIC AMERICAN, INC

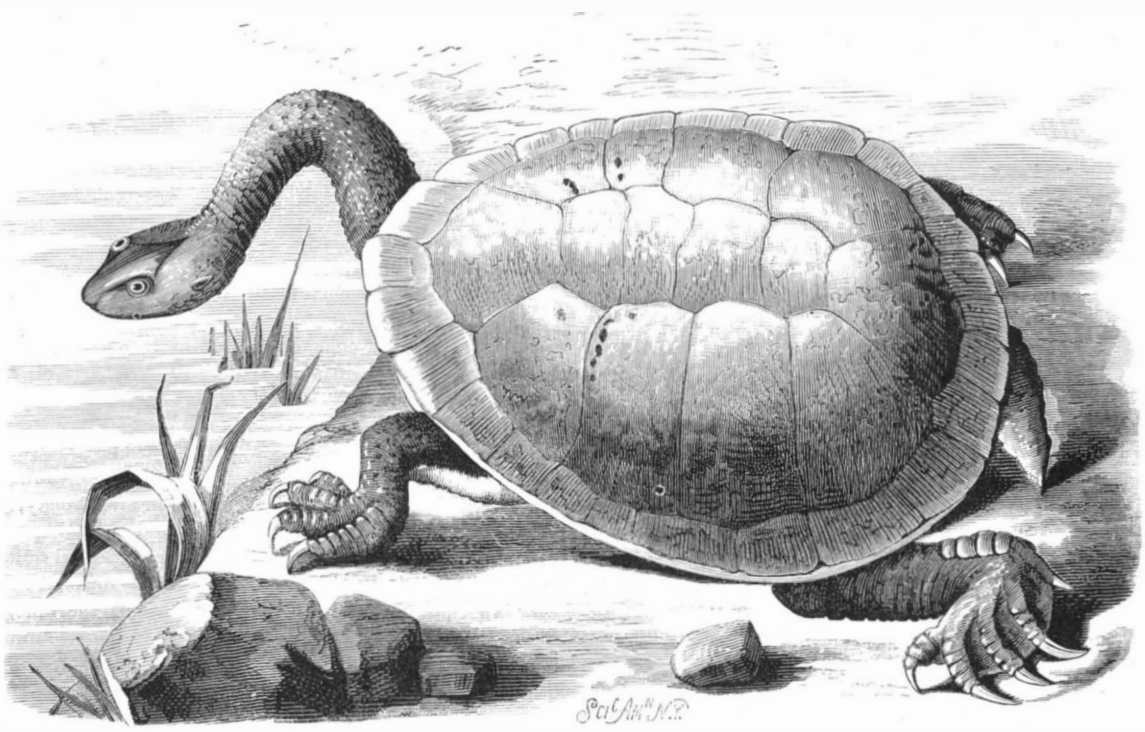
THE LONG-NECKED CHELODINE.

BY C. FEW SEISS.

The long-necked chelodine (*chelodina longicollis*, Gray) is a native of Australia. The chelodines occupy much the same position in the Australian fauna which the soft-shelled turtles, *trionychidæ*, and the snapping turtles, *chelydridæ*, do in the American.

This chelodine is very remarkable for the great length of its neck, which may be termed both swan-like and serpentine, and indeed may almost be compared to that of the plesiosaurus of the liassic period, but of course in miniature. On account of this extraordinary length of neck, the chelodine is unable to draw its head and neck within the shell. This is contrary to the habits of a vast majority of the tortoises, and to all American species with which I am acquainted. When disturbed or frightened it hides its head under the side of the shell.

The chelodine is said to be fierce and rapacious, feeding upon fishes and various other animals. The superior surface of the head, neck, feet, and legs is blackish-gray or brown in color; the carapace (upper shell) is dull yellowish-brown, with pale mottled net-like markings, and a few brown spots; the plastron (under shell) is peculiarly broad and oval in front, and the plates are surrounded by a dusky border.



THE LONG-NECKED CHELODINE.

Phosphorescence of Sulphate of Quinine.

If some sulphate of quinine is strewn over a sheet of smooth paper and exposed to a heat of from 120° to 140° Fah. by means of a plate of metal, it becomes phosphorescent when stirred with a glass rod. Valeriate of quinine exhibits the same phenomenon without heat being applied, if the crystals are rubbed in a mortar.

THE HIGH SCHOOL OF KOLAPORE, INDIA.

The native Indian State of Kolapore, in the Deccan region, two or three hundred miles southeast of Bombay, India, contains half a million of people. Some years ago a high school was established at Kolapore, upon the plans of Sir Alexander Grant, then Director of Public Instruction in the Bombay Presidency. The school has prospered, and has been found useful to the native youth of the upper classes in Kolapore, being constantly attended by 300 students. The building, of which we give an illustration, has been constructed from the designs of Captain C. Mant, R.E., Executive Engineer. Its interior arrangements are suitable to the purpose, with twelve class rooms for the accommodation of 350 or 400 pupils, a lecture hall, a museum, and convenient offices. The style of architecture adopted is the Hindo-Saracenic, to agree with that of the adjoining gateway of the Palace Yard. The building is exceedingly ornate, and forms an excellent example of a new architectural departure, for such the adaptation of the peculiarly Indian design to a building of this character may well be considered.

American Salmon in New Zealand.

Intelligence has been received of the safe arrival in Auckland, New Zealand, of 40,000 salmon eggs from Columbia river. These eggs were sent from San Francisco by steamer, consigned to the Napier Acclimatization Society; but on arrival at Auckland they were found to be so far advanced that it was determined not to risk sending them all to Napier, but to distribute them immediately in suitable localities in the neighborhood. One half was thus treated, and the remaining 20,000 were sent on to their original destination, Napier. There is every probability that an actual colony of salmon has now been planted in New Zealand, for the fry were in a healthy condition, and great care was taken by Mr. Firth to protect those placed in the rivers from all enemies.

THE DOUBLE POSTAL CARD.—A new style of postal card has been introduced in Germany. It consists of two cards of the ordinary size attached together, each stamped, the object being to facilitate the return of answers.

AMERICAN coffins are now being exported to England.

The Effect of Diet on Liquor Drinking.

Charles Napier, an English scientific man, has been testing the truth of Liebig's theory that liquor drinking is compatible with animal food but not with a farinaceous diet. The experiment was tried upon 27 liquor-drinking persons with results substantiating the Liebig theory. Among the most striking instances of reform brought about by a change of diet was that of a gentleman of 60 who had been addicted to intemperate habits for 35 years; his outbursts averaged one a week. His constitution was so shattered that he had great difficulty in insuring his life. After an attack of delirium tremens, which nearly ended fatally, he was persuaded to enter upon a farinaceous diet, which, we are assured, cured him completely in seven months. He seems to have been very thin at the beginning of the experiment, but by the close of the period named had gained twenty-eight pounds, being then of about the normal weight for a person of his height.

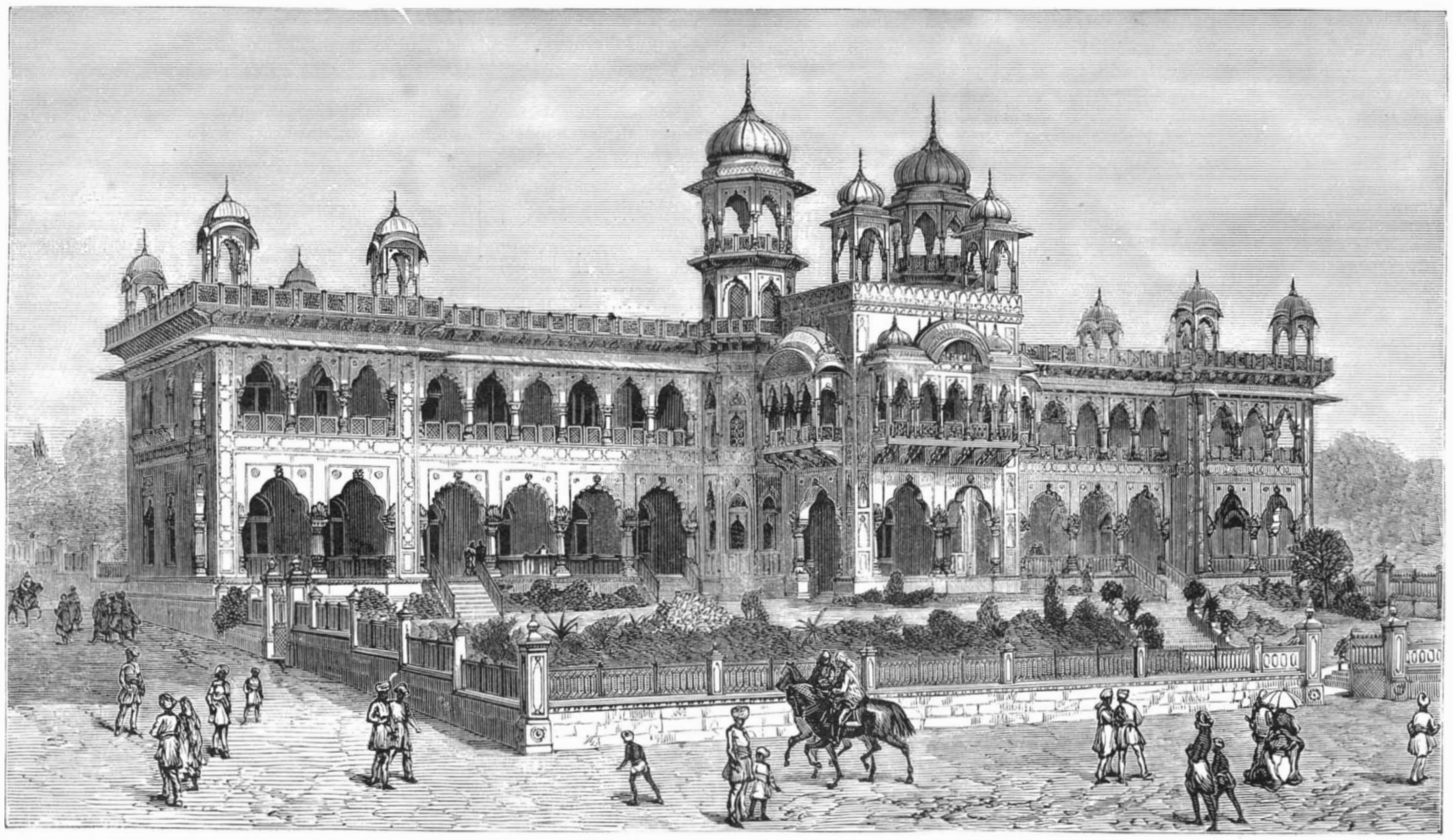
Among the articles of food which are specified by Napier as pre-eminent for antagonism to alcohol are macaroni, haricot beans, dried peas, and lentils, all of which should be well boiled and flavored with plenty of butter or olive oil. The various garden vegetables are said to be helpful, but a diet mainly composed of them would not resist the tendency to intemperance so effectually as one of macaroni and farinaceous food.

From this point of view, highly glutinous bread would be of great utility, but it should not be sour, such acidity being calculated to foster the habit of alcoholic drinking. A like remark may be applied to the use of salted food.

If we inquire the cause of a vegetarian's alleged disinclination to alcoholic liquors we find that the carbonaceous starch contained in the macaroni, beans, or oleaginous aliment appears to render unnecessary, and therefore repulsive, carbon in an alcoholic form.

The Arrival of the Obelisk in England.

Cleopatra's Needle has passed the perils of the Bay of Biscay and the Channel, and has reached Gravesend in safety. The New York *World* says that after its erection in London Mr. Dixon will be at liberty to set about carrying out the proposition made in this city by his representative some months ago. That proposition having been accepted by a liberal citizen of New York, we may hope at no very distant day to hear that the "needle ship" has been dispatched upon its second and, to Americans, more interesting mission.



THE HIGH SCHOOL OF KOLAPORE, INDIA.

© 1878 SCIENTIFIC AMERICAN, INC

WHALES AND WHALEBONE.

We present in this issue a series of diagrams taken from actual measurements of the Greenland whale (*balæna mysticetus*), showing the manner in which the whalebone, so-called, is arranged in the head; and also a full length portrait of the animal from which the drawings were made. For these illustrations we are indebted to *Land and Water*.

The mode of the progressive growth of the baleen, or

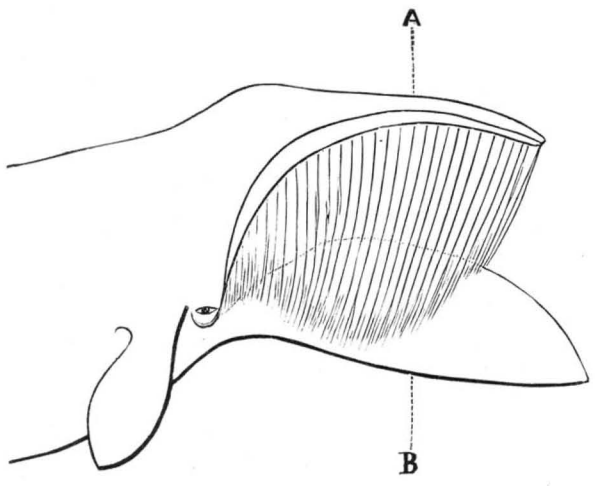


Fig. 1.—Position of the whalebone when the Whale is feeding, mouth open. A, Crown Bone. B, Lower Jaw.

whalebone of commerce, is a modification of the design adopted in the tooth of the rabbit or the tusk of the elephant. The baleen is wrongly called whalebone. It certainly comes out of the whale, but there is no bone whatever in its composition. It is composed of hardened hairs which are united one to the other by a kind of animal glue.

The principal food of the Greenland whale consists of a small crustacea not larger than the common house fly, which is found in greatest abundance when the temperature of the sea is from 34° to 35° Fah., the ordinary temperature among ice being 29°, the color of the water varying from dark brown to olive green and clear blue, the blue water being the coldest. To catch them teeth would not be of the least use to him. The only thing to be of use would be a sieve. Aristotle first remarked this fact. "*Mysticetus etiam pilas in ore intus habet vice dentium suis setis similes*"—"The whale has hairs in his mouth instead of teeth, like the hairs of a pig." On this Professor Owen remarks: "To a person looking into the mouth of a stranded whale the concavity of the palates would appear to be beset with coarse hair." The species of *balænoptera*, which frequents the Mediterranean, might have afforded to the father of natural history the subject of his philosophical comparison.

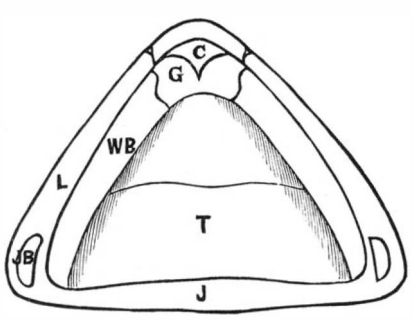


Fig. 3.—Section of Whale's Mouth shut. C, Crown Bone. G, Gum. WB, Whalebone. T, Tongue. L, Lips. J B, Jawbone.

Fig. 1 shows the mouth open and the position of the whalebone when the animal is feeding; it is drawn to a scale, and is a good representation of its appearance. It will be noticed that the correct number of slips of whalebone, which amount to 300 on each side of the head, are not filled in, only a few lines being drawn, showing the direction they take toward the lower jaw when the mouth is open. The number of blades of whalebone in a whale's head have been counted and found to be 286 on the left and 289 on the right side of the head. Along the middle of the crown bone the blades of whalebone are separated from each other by three quarters of an inch of gum, but the interval decreases both toward the nose end and throat to a quarter of an inch. The gum is always white; in substance it resembles the hoof of a horse, but softer. It is easily cut with a knife or broken by the hand, and is tasteless. The whalebone representing the palate is lined inside the mouth with hair, for the purpose of covering the spaces between the slips, and preventing the food on which the whale subsists from escaping; this hair is short at the root of the mouth, but is from twelve to twenty inches long at the points of the whalebone. This it requires to be, because when the mouth is opened the bone springs forward, and the spaces are greatest at the points. Hitherto it was believed that the whalebone had room to hang perpendicularly from the roof of the mouth to the lower jaw when the mouth was shut, but such is not the case. The bone is arranged, as will be seen from the sketch, to reach from the upper to the lower jaw when the mouth is open; were it otherwise, the whale would not be able to catch its food; it would all escape underneath the points of the whalebone.

Fig. 2 shows the position of the whalebone when the mouth is shut. The dotted lines show the jaw bone, and the black the whalebone curving toward the throat. In the first figure it will be observed that the line formed by the lower ends of the whalebone blades is hollowed out near the throat, in consequence of the shortness of the blades at this spot. This shows that it is for the purpose of allowing room for the points of the whalebone to lie in when the mouth is shut. The whale has no muscular power over its whalebone, any more than other animals have over their teeth. When the animal opens its mouth to feed, the whalebone springs forward and downward, so as to fill the mouth entirely; when in the act of shutting it again, the whalebone being pointed slightly toward the throat, the lower jaw catches it and carries it up into the hollow before described.

Fig. 3 is a cross section, cut half way between the blow holes and nose end, showing the mouth shut, and the arrangement of the lips, jaw bones, tongue, and whalebone.

Fig. 4. is the same section showing the mouth open. It conveys a good idea of the great capacity of the mouth when open compared with the comparatively small space it has to hold the whalebone in when the mouth is shut.

Fig. 5 is the whale from which these measurements were taken, and is said to be the best representation of the *balæna mysticetus* yet made. The dimensions are as follows:

	Ft.	In.
Length from nose to tail	47	0
Length of head from nose to eye	17	8
Breadth of body between the fins	11	0
Breadth of head across the jaw bones	9	3
Breadth of lip, including jaw bone	5	5
Gape	10	8
Breadth of tail	20	0
Length of whalebone	10	1

These measurements are of special interest and value in view of the absence heretofore of similarly careful and detailed information. They are taken from a specimen captured last year by Captain David Gray.

Longevity of Trees.

From observations made on specimens still in existence, the longevity of various trees has been estimated to be, in round numbers, as follows: Deciduous cypress, 6,000 years; baobab trees, 5,000; dragon tree, 5,000; yew, 3,000; cedar of Lebanon, 3,000; "great trees" of California, 3,000; chestnut, 3,000; olive, 2,500; oak, 1,600; orange, 1,500; Oriental plane, 1,200; cabbage palm, 700; lime, 600; ash, 400; cocoanut palm, 300; pear, 300; apple, 200; Brazil wine palm, 150; Scotch fir, 100, and the balm of Gilead about 50 years. Such examples are quite sufficient to prove the truth of a remark of Schleiden's that there seems to be "a possibility of a compound plant living on without end."

The Latest Overland Journey through China to India.

Lieut. Gill, an English officer, has lately completed a successful journey through China to India. He left Shanghai in February, 1877, and arrived in December at Rangoon in British Burmah. Reference being made to the geographical positions of the principal places visited, as Hankow, Sungpan-ting on the borders of Coconoor, Bathang, Talifoo, and Bhamo, it will be seen that he traveled in a southwesterly direction, following the course of the Yang-tse-Kiang into Thibet, and then moved southward. During the most difficult and perilous part of the journey, namely, from Chengtu to Burmah overland, he was accompanied by Mr. Mesney of the Chinese service. Mr. Gill, speaking of this part of the journey, compares it to "continually going up a stair-

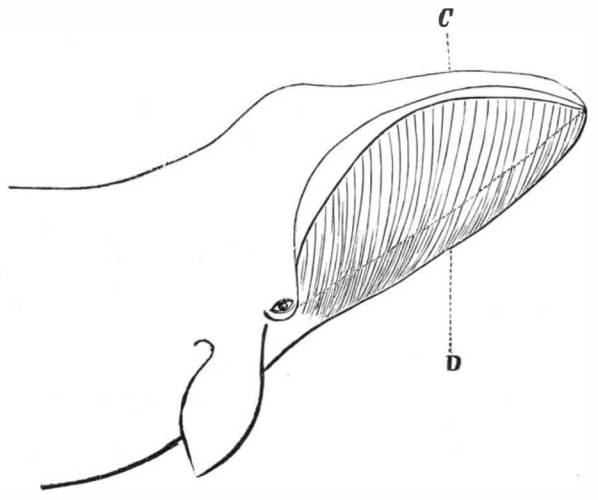


Fig. 2.—Mouth of Whale shut. The plates of whalebone packed away by the action of the lower jaw. C, Crown Bone. D, Lower Jaw.

case." Roads there were none, the way consisting of mere tracks through a rocky, mountainous country. In the neighborhood of Bathang, which is almost in the thirtieth degree of latitude and quite on the borders of Thibet, ranges were crossed some 15,600 feet high. The most common tree near Bathang is the pine, which in some places was seen in magnificent forests, and the trunks of many of which are three feet in diameter.

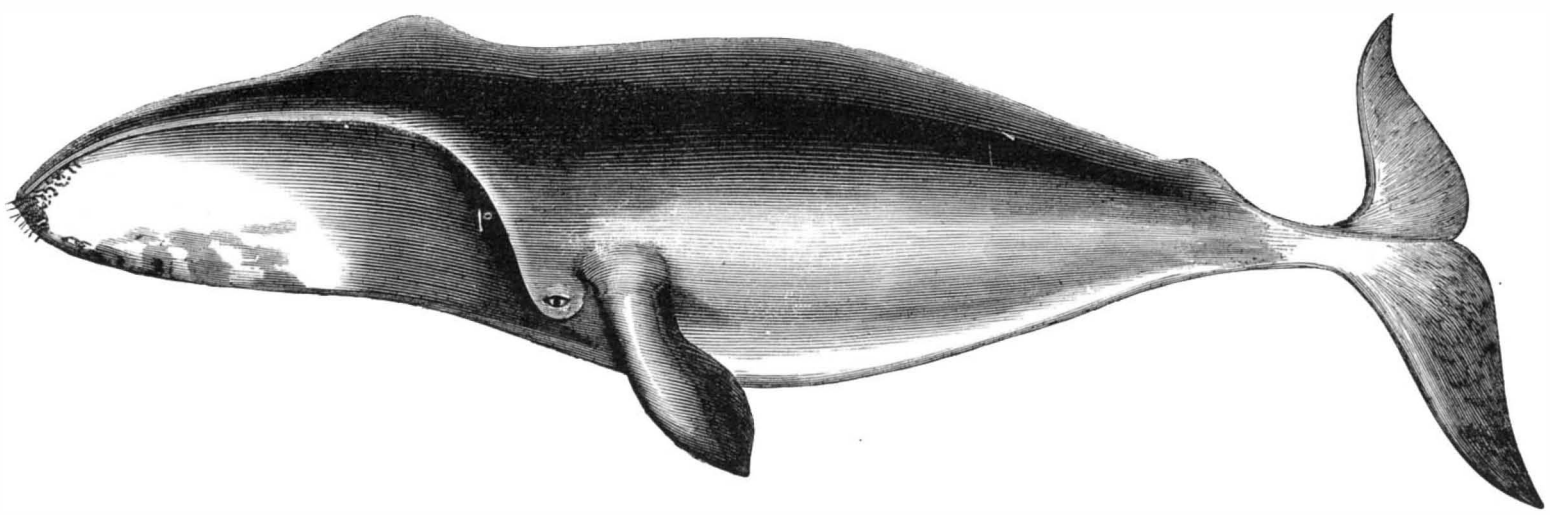


Fig. 5.—WHALEBONE WHALE ("BALÆNA MYSTICETUS") OF THE GREENLAND SEAS.

In the first part of the journey, after leaving Hankow, which is an open port on the Yang-tse-Kiang, and a four days' journey by steamer from Shanghai, he visited Tsi-liutsing and examined the fire wells there. These wells go down some 3,000 feet below the surface, and an inflammable gas finds its way out of them. There are also brine wells, and these go down to about the same depth. The natives manufacture excellent salt of the brine. On the way from

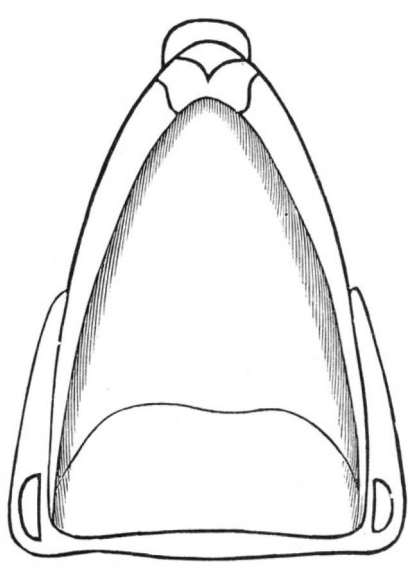


Fig. 4.—Section of Whale's Mouth when open.

Mandalay in Burmah to Rangoon, the travelers observed a marked difference between the two political sections of the country—Native and British Burmah. In the latter were cultivated fields, pleasant homesteads, and contented people, which contrasted strangely with the state of things in the former.

© 1878 SCIENTIFIC AMERICAN, INC

New Mechanical Inventions.

An improved Machine for Separating Fur from Pelts or Hides has been invented by Mr. Samuel M. Ball, of Fanwood, N. J. In this machine the fur is removed from the skin by a combination of pickers, carrying aprons, and separating screens, arranged in a compact manner. The machine is cheap as well as simple.

Mr. Gideon McBride, of Dover Hill, Ind., has invented an improved Tellurian for the use of schools, etc., which in a simple manner illustrates the elliptic orbit of the earth around the sun and that of the moon around the earth, together with all the phenomena resulting from the relation of these bodies to each other.

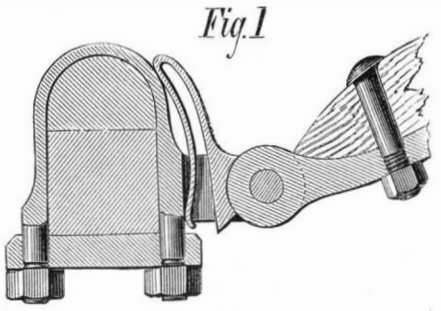
Mr. Lorenzo Meeker, of Oswego, N. Y., has invented an improved Lifting Jack. This has a peculiar construction of a clutch and lever for lifting the load, in combination with a clutch for sustaining it during the alternate movement of the lifting clutch, and differs from other lifting jacks in the construction and arrangement of the sustaining clutch and lever, and in the devices for disengaging the clutch from the bar when it is desired to retract or lower the latter.

In a new Millstone Gearing devised by Mr. Garrett W. Schreurs, of Muscatine, Iowa, the spindle of the runner stone is so stepped and geared that its motion can be instantly stopped at pleasure or in event of an accident.

BEARD'S THILL COUPLING.

The annexed engravings represent a new invention designed to prevent carriage thills from rattling. It consists of

Fig. 1



a steel spring, and the manner of its operation will be seen at a glance from our engravings. It is claimed that this spring is neat, cheap, effective, and far more durable than rubber. It can be inserted without uncoupling the thill or removing any part of the vehicle. Fig. 1 is a section of the entire device, and Fig. 2 shows the spring separate. It was patented October 30, 1877, and is sold by Luke Beard, 75 Hubbard avenue, North Cambridge, Mass.

Fig. 2

A Telephonic Alarm.

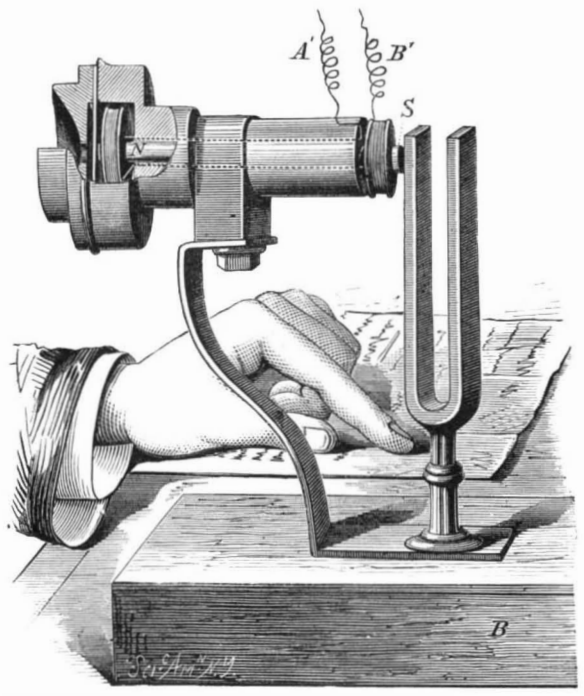
The speaking of the telephone is admittedly so weak that it can only be caught by keeping the instrument in immediate contact with the ear. Hence there is transmitted through the telephone in its present form no sound which would be intense enough to announce to any one who was in a large room, and who did not hold the telephone close to his ear, that a message was about to be sent from the transmitting station. The consequence is that a warning apparatus must be attached to the telephone, so that there may be no fear of missing a projected telephonic conversation.

It is clear that the conducting wire of a telephone can be used to sound a bell as an alarm by means of a current from a galvanic battery, and thereby the defect referred to would be supplied. But the necessary apparatus would considerably raise the price of fitting up a telephone apparatus, and besides, one most important property of the telephone, viz., producing the required electric current automatically, would be partly lost. I have, then, invented another warning apparatus, which, I believe, is quite workable.

Hitherto telephones have been so constructed that only one pole (N in the figure) of the magnet is effective; I now use also the second pole, S, by providing it with a coil of wire, which is simply inserted in the circuit behind the first coil. (The dotted lines in the figure will explain this connection; the two ends A′ and B′ are connected with the binding screws fastened to the telephone; from this the circuit goes to the second telephone.) Before this pole of the magnet a tuning-fork, A, may be very easily set up, which, with the telephone, is simply fixed on a resonance case, B; this arrangement should be made both at the transmitting and receiving stations, and both forks should be in unison. If now the sending station wish to signal that a conversation is to be begun, the fork of that place will be sounded with a fiddle-bow; the currents thereby induced in the coil are powerful enough to set the fork of the receiving station in such intense vibration that the sound may be distinctly heard in a large room; warned by this signal a person can in the usual way put the telephone to his ear and listen to the words from the transmitting station; and so *vice versa*.

I have made an experiment in a large room, when about 100 people were present, and all could hear the sounds of the fork, which in the manner described was set in vibration by a second fork in a distant room. The two forks were König Ut_4; lower forks give less clearly heard tones; with higher forks I was unable to make any experiment, since I had not two similar ones at my disposal.

Let me mention two other experiments which I have made. The first is of importance in connection with the question as to how the clang-tints of tones are reproduced through the telephone. In one of the two telephones described substi-



THE TELEPHONIC ALARM.

tute for the Ut_4 fork a higher one, and sound this by means of a fiddle-bow, and there will be heard with another inserted telephone of the ordinary construction tones of even 12,000 double vibrations per second, a sign that the variations of the magnetic condition of a magnet perceptibly occur, even when the forces producing these variations change their size 24,000 times in a second. This result, moreover, was not to be expected, since, as is known, magnetic polarization requires time to accomplish. Whether these higher tones are comparatively weaker than the deeper cannot be determined, but probably this is the case.

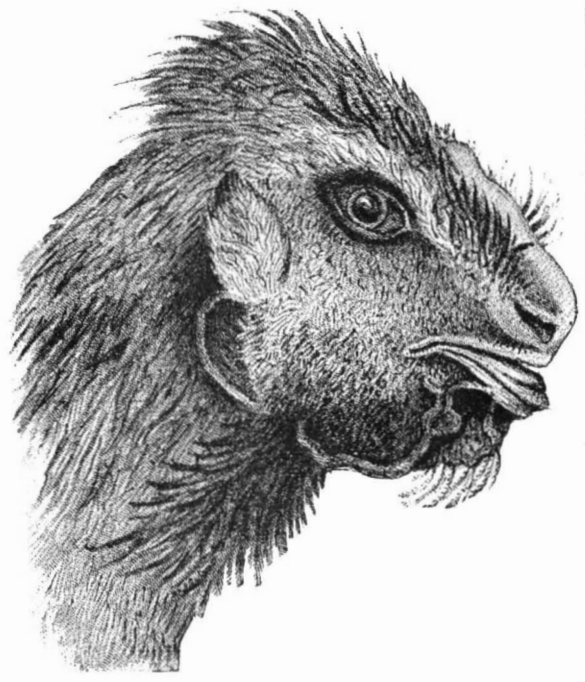
In another experiment I used the telephone to test the electric vibrations indicated by Helmholtz and others, which are produced by the opening of the primary current of an induction apparatus in the induced coil, when the ends of the latter are connected with the armatures of a condenser. For this purpose I inserted the telephone in the circuit between coil and condenser, and observed the effect when the current in the inducing spiral was opened.

When the ends of the induced spiral were not connected with the condenser, I heard a dull report in the telephone; when again these ends were connected with the condenser, this report was accompanied by a shorter, higher sound, whose vibration-number might perhaps be determined by a musical ear; a proof of the existence of the vibrations mentioned in the last case. The observations were made with a telephone the iron membrane of which was very thin and had a very deep tone.—W. D. RÖNTGEN, *in Nature*.

A FOWL MONSTROSITY.

BY JOHN MICHELS.

An interesting instance of a strange malformation in the head of a fowl has been exhibited alive at the New York



A FOWL MONSTROSITY.

Aquarium, and as Professor Fr. Stengel of Columbia College vouches for its authenticity, it may be presumed to be a genuine specimen.

The illustration will convey an excellent conception of the peculiarities of the fowl in question, which is said to have a monkey's face. It will be noticed that the ordinary beak of a bird is absent, and that the nose and lips of an animal are fully developed.

The nose appears to be formed by an extension of the comb, which at the point of junction suddenly changes from a bright red to a pale fleshlike color; the lips, which are large and protruding, having the same hue.

Both lips and nose are formed of a moderately hard cartilagenous substance, having a smooth surface, the nostrils being very similar to those observed in many species of monkeys.

The tongue is also modified in form, rounded at the point, and having unusual power of lateral motion.

With the exceptions I have named, or shown in the illustration, the general appearance of the specimen is normal, and indicative of its being of the Cochin China breed.

We have doubtless here an interesting specimen of one of those strongly marked and abrupt deviations of structure which occasionally occur without any apparent cause.

Such cases are rare with birds in a state of nature, but happen with greater frequency with those which have become domesticated.

This monstrosity probably arose from an arrest of development rather than arrest of growth, and is doubtless capable of being transmitted. Breeders take advantage of such freaks of nature to produce what is called a variety.

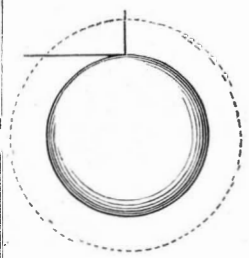
Speaking generally, it is conceded that changed conditions and external influences produce variation from type, and considerable effect upon organisms of all kinds.

There are, however, instances in which decided variation arises without any apparent exciting cause, and Darwin with his usual caution "provisionally" calls it "spontaneous;" he attributes such variations, whether consisting of slight individual differences or of more strongly-marked deviations of structure, as depending much more on the constitution of the organism than on the nature of the conditions to which it has been subjected.

The Apparent Size of the Moon.

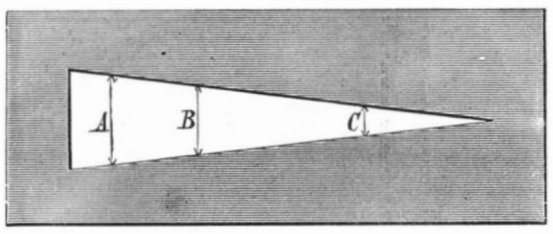
To the Editor of the Scientific American:

You have frequently noticed that the moon looks very much larger when it rises and sets, than when it is nearly overhead, on the same night, the objects on its surface appearing magnified. I have accounted for the variation in its apparent size on the principle of the refraction of light, more rays being bent and brought to the eye while they pass through the dense medium, when the moon rises and sets, than when the rays pass through a rare medium, as when the moon is nearly overhead.



The rays, when the moon is near the horizon, pass through more air than when directly overhead.

I have heard it said, and think I read it in the SCIENTIFIC AMERICAN, that the moon only looked larger by comparison with objects near the horizon. It did not occur to me how to test the matter until a short time since I made a triangular hole through a piece of card board and placed it 21 inches from my eye and looked through it at the moon. When it was rising near the horizon it would fill the space marked *A*, sometimes *B*, and (when overhead) *C*.



Does not this prove that the moon does really look larger by being magnified through the medium of the air?

Please mention this in your paper with remarks, which may enlighten others. Yours, etc, OBS.

LACONIA, N. H., Dec. 25, 1877.

A. This apparent difference in the size of the moon, according to its position in the heavens, is (as has been frequently explained before) merely an optical illusion.

When we regard the celestial vault, it has the appearance to us of a very much depressed spheroid, instead of a hemisphere, and, for this fact, the zenith looks much nearer. In looking at objects along a horizontal plane, we are accustomed to estimate their relative sizes and distances by comparison. Now, in viewing objects situated above, as we lack the same means of comparison, and hence are apt to greatly under-estimate their distance, the rising moon may appear much larger than a tree placed beside it on the verge of the horizon; but, when she reaches the zenith, the tree (which at the horizon served to give us an idea of greater distance) being absent, we with our under-estimate of vertical distance unconsciously make an exaggerated allowance for it, and, doing this, we likewise underestimate the apparent size of the moon and see it smaller.

COL. W. H. REYNOLDS has concluded a contract with the English Government by which the Post Office Department has adopted the Bell telephone as a part of its telegraphic system. In a recent telephonic experiment in connection with the cable, 21¾ miles long, between Dover and Calais, there was not the slightest failure during a period of two hours.

© 1878 SCIENTIFIC AMERICAN, INC

Photo Hash.

BY E. V. DAKE.

To clean Negative Glass.—Put them in a stone jar; fill it up with cold water, set it on the stove till it boils; when cool wash up by laying them flat on a board and using a common splint scrubbing brush.

To prepare Albumen.—Take the whites of 8 eggs, be sure and take out the germ; to this add 24 drops of glacial acetic acid, diluted with 1 oz. pure water. Stir well, leave it stand 2 hours, then strain through a piece of muslin, then add 1 drachm of ammonia, and you will have a stock solution that will keep for a year at least. For use, take 1 oz. of stock solution and add 30 ozs. pure water, filter through 6 thicknesses of muslin.

The Albumen Brush.—Instead of flowing the plates with the albumen, use what I think is called the mansard brush—make it yourself, as follows: Take a piece of glass three inches wide and 6 inches long, fold four thicknesses of Canton flannel over one end, and slip on a rubber ring to hold it in place—wash it thoroughly to free it from lint and dust, and set it in the dish containing the albumen (a glass goblet is a nice thing). After washing the plate, dip it into a pail of pure, warm, filtered water, let drain a moment, then draw your brush from top to bottom, and the work is done.

To prevent Pinholes.—There is a great deal said about pinholes in negatives, and their cause; one great hobby is an over-iodized bath; now, say you have 2 quarts of bath, 45 grains strong, iodized to saturation. That bath will not give pinholes, if dust and foreign matter is kept out, unless you impoverish it or waste the bulk of it. I claim that if you keep the same quantity of bath with the same strength of silver, you never will get pinholes from over-iodizing.

Retouching Varnish, for a soft pencil.—Alcohol, 8 ozs.; gum sandarac, 7 drachms; Venice turpentine, ½ oz.; camphor, 1 drachm; dry without heat—gives a soft tone to the negative, increases the intensity, and gives a tooth that will take hold every touch.

Varnish for a hard pencil.—To do a very fine job, take white lac, 1½ lb.; alcohol, 1 gallon; dry the lac and pound it fine, add to the alcohol, keep warm till dissolved, then filter; should be as thick as you can flow without ridges.

To prepare the varnished surface for retouching, take some powdered pumice stone, sprinkle over the face, and with the ball of the second finger commence a circular motion and grind the surface till you have the desired tooth; in touching, if you get too much lead on some part, you can easily remove it with a piece of rubber by dipping it into the pumice stone and grinding that particular spot.

A tray for floating paper and toning.—Make a box 4 inches deep, 19x24 inches inside; have the bottom in one piece, and put the bottom in the middle so you will have a double tray, one side for toning and the other for floating paper; to prepare it for use, take 1 lb. of good beeswax and melt it, lay the tray on the stove and warm it well, then flow the wax all over the inside, let it cool, then flow again, then give an extra flow around the corners. I made one seven years ago; has never leaked a drop, and is clean and healthy to-day as you could wish. Washing trays can be made by using half inch boards well nailed together the size you wish, and lined inside with white oilcloth, fitting it into the bottom well and tacking on the outside edge; very cheap, and will last for years.

To remove the Hypo.—Seven years ago Mr. Newton gave a formula for cleaning prints from hypo in a very few minutes. In the *Mosaics* for 1877 he reiterates the statement, and I have often wondered whether photographers generally have availed themselves of this little dodge. I have used it ever since I first saw it, and have made prints every year for the past seven years, and whatever other faults may be found with them, they have never been troubled with hypo. I use the acetate of lead, 2 ozs. in 16 ozs. water, which is a stock solution—2 ozs. of stock solution in 1 gallon of soft water form the wash for prints. Pass the prints through three waters after fixing, then into the lead wash; keep them in it for ten minutes, then rinse three times and your prints will be perfectly clean; if the water turns milky when you add the lead, add a few drops of acetic acid, and stir just enough to make it clear.

When to trim.—I visited a gallery in a city larger than ours not long since and found the printer trimming his prints, but they were all toned, fixed, washed, and dried. I don't know but what most printers do the same way, but they could not do it for me; times are too hard to squander time and money that way.

After printing, trim all your prints nicely to just the size you wish before toning; if you are an artist you will not tear one in ten thousand in the subsequent manipulations; by doing so you can save your clippings for the refiner, and won't need more than half the gold to do your toning.

When your prints are washed, lay them face down in a pack, press the water out of them, then paste the first one, take it by the corner and lay it on the card and rub down, and so with the next; in this way you will save silver, gold, time, and labor.

Corn starch makes a splendid clean paste. You can get just as good a gloss on your prints by rubbing them over with a piece of white Castile soap as you can to dissolve it in alcohol, and soak your prints up with that. Try it.

Have a rule to work by; don't guess so much, even if you are a Yankee; a handful of this and a cupful of that in a careless way may work well seven times out of ten, but may fail you the next three times, and cause you to lose your time, temper, money, and your customer.

How to get gold and silver.—Because there is a good margin in photography, it is no reason you should not practice economy. I have a friend who has been squinting through the camera for the last ten years, does good work, and always has a fair run of business, and yet he has not seemed to get along financially as he ought to. Of course there may be many reasons why, but when I visited his rooms this summer I found out some of them: When he develops a plate, he does it over the sink, and all the excess of silver goes out the waste pipe; washing from prints goes into the sink, and consequently the silver goes out the waste pipe; makes new toning every time he tones a batch of prints, and when done with it throws it into the sink, and so the gold goes out the waste pipe; three fourths of the money he spent for silver and gold was a dead loss; it went out the waste pipe to return to him no more forever. Try another way: develop over a stone pan, let the excess of developer and silver go into it, also the first water that covers the plate in washing; it will keep evaporating, so you can use it for a year before you clear it up and send the contents to the refiner.

Save the first three waters from your prints in a cask or tub, and at each saving add common salt and stir well. When full, let settle, then draw off the water to within three inches of the bottom by putting in a faucet, or even by boring a hole and fitting a plug to it nicely.

Wipe out your holder every time you use it with a cloth; when the cloth becomes foul throw it in with your clippings—catch every drop of silver solution on something; the bulk of your bath is composed of drops, and every drop contains money.

Keep up the price of your work for mercy's sake don't make people think you are only a half-made photographer by offering them work at half price; people are willing to pay a good price for good work.

Never force your work on your customers; if they are not suited with it do not let them have it at any price; they will soon learn that you think as much of your reputation, as an artist, as you do of their money.

Keep your temper before your customers (now I know I am setting you a hard task, but it must be done); even after giving Miss Nancy four sittings, while others are waiting, and then she finds that one of her spit curls has not got just the exact curve she desires, and must sit again; let her sit, for you can plainly see and hear that she has a tongue (and I believe all women have), and that tongue had better wag in your favor than against you.—*St. Louis Practical Photographer.*

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, February 9, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	5 52 mo.	Saturn sets	7 43 eve.
Venus sets	7 06 eve.	Uranus rises	5 53 eve.
Mars sets	11 45 eve.	Uranus in meridian	0 44 mo.
Jupiter rises	5 43 mo.	Neptune sets	11 34 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	2 41 mo.	Sirius in meridian	9 20 eve.
Regulus rises	5 58 eve.	Procyon in meridian	10 13 eve.
Spica rises	10 35 eve.	Aldebaran in meridian	7 09 eve.
Arcturus rises	9 38 eve.	Algol (var.) in meridian	5 41 eve.
Altair rises	3 58 mo.	Capella in meridian	7 48 eve.
Vega sets	6 07 eve.	7 stars (cluster) in meridian	6 21 eve.
Alpheratz sets	10 33 eve.	Betelguese in meridian	8 29 eve.
Fomalhaut sets	5 31 eve.	Rigel in meridian	7 48 eve.

REMARKS.

Mercury rises 1h. 10m. before the sun, and 9° 6′ 24″ south of the sunrise point, February 10. Venus has the same right ascension, and is only 53′ south of *η Aquarii*, the southeast star of the λ. Mars and Neptune are in conjunction; Mars being 3° north. They are in *Aries*, almost directly south, at dark. Jupiter rises 1h. 19m. before and 9° 44′ south of the sun. Saturn is in *Aquarius*, 15° southeast of Venus. Uranus is 26′ north and 1′ west of Regulus. This and the following week will be the best time to look for Uranus this year. Algol at minimum brilliancy February 11, 7h. 52m. evening. Mira will not attain its maximum brilliancy until the middle of October, 1878.

Turnery Woods.

In the Eastern Archipelago many woods are found which might probably be utilized if they were better known and introduced into European commerce. A few notes are therefore furnished of some.

Sawoe or sauw (*Mimusops Kauki*, Lam.) is found in Bali and Java. The wood is red and flamed, of hard texture, close grained, and easily worked. It equals box for turnery work and engraving. The hard seeds, called kitjeh, are used for markers in games.

The gray wood of Seroet (*Streblus aspera*, Lour.) of Java, deposited for some time in running water, petrifies, and is used for making bracelets and other ornaments. Under the name of Tjautige or sautige several small trees grow in the central and eastern mountainous regions of Java which are known for their hardness as iron woods. The brown close wood is said to be good for turnery work.

Papila.—This, one of the Rubiaceæ, is a tree of thirty feet high by eight inches in diameter, growing at Gorontalo. The wood is straw colored, lustrous, of a compact texture, resembling ivory. It is easily worked, is like boxwood, and would be of great value for wood carving or delicate turnery work. Another similar wood is Tolotio, which is either *Kleinhovia hospita*, Lin., or would seem to be allied to the genera *Nauclea* and *Blackwellia.*

Toulimoe, a fruit tree of Gorontalo, has a straw colored veined wood, with fine undulated fiber. It is knotty and not easily worked, but seems fit for turnery.

Doenata (*Glochidion molle*, Bl.).—This is another tree of Gorontalo, about eighteen feet high by eight inches diameter, which has a fine, compact, straw colored wood, well fitted for wood carving and turnery work.

Doedock (*Pemphis acidula*, Forst.) is a small tree growing on the sea coasts, with wood of a fine solid texture, brown color and velvety luster. It is knotty, but fit for turners' work.

Glingsem (*Blackwellia tomentosa*, Vent.) grows in Central Java. The inner wood is of a lustrous brown with glossy spots. It is compact and heavy, and much used for turnery work.

Kajoe-fanasa, an undefined tree growing in the Arru Islands, south of New Guinea, has a satiny yellow wood, hard, fine grain, fit for turnery purposes.

Kemoening (*Murrya paniculata*, Dec.) is much valued by turners.

Lameh (*Alstonia spathulata*, Bl.) grows in the mountain regions of Preangan, Java. The wood is clear, dense, with pure grain, works well, and is used in Europe for carving.

The Letterwood of Amboyna has a close resemblance to that of Guiana, and is probably a variety of *Brosimum Aubletti.*

Deamoedjoe (*Podocarpus cupressina*, R. Br.) is found in the higher regions of Preangan. The wood being light colored, and of a pure grain, is much valued for technical purposes, especially for wood carving.

Djoengkiel (*Celtis reticulata*, Torr.), found in the west of Java, has a firm and solid wood, which is useful for different technical purposes.

Before concluding these few notes, it may be added that the wood of the Gummarium, genus *Ignotium*, of Brazil, is said to be an excellent substitute for box for wood engraving.—*Journal of Applied Science.*

Cultivation of the Sunflower as a Protection against Malaria.

On this subject we have received from a correspondent a communication which, containing no facts that are not already familiar to the public, we deem unnecessary to publish.

However, for the benefit of those persons who may still be cultivating the unsightly sunflower, under the impression that it really possesses some hidden power to ward off malaria, we may state that this notion was long ago exploded, and now ranks only with such remedial absurdities as the carrying about in the pockets of horsechestnuts and potatoes as prophylactics of rheumatism, or the equally ludicrous one of basking in light that streams through "blue glass."

Notwithstanding the romance attached to its origin by mythology, it is about as coarse, ugly, and useless a plant as we know. With nothing about it to please the eye, with no medicinal qualities whatever to give it value, the only possible economic use to which it can be put is that of cultivation for the sake of an oil that its seeds yield. But whatever value it might have for this purpose is more than counterbalanced by the positive injury it does to the soil, for it is well known as an insatiable consumer of potash, and would rapidly exhaust any land of this already too scarce salt, and hence render it unproductive. The proper place, then, for this unpromising exotic is where we chiefly find it—the gardens of rural districts, in which it is often planted to hide objects that have the misfortune to be still more unsightly.

As regards the *eucalyptus*, which our correspondent incidentally mentions, we believe it is not generally held by scientists that the mere presence of the growing tree in any district will prevent the occurrence of malaria, but that its value as a remedial agent depends on the presence in its leaves and bark of a resin and alkaloid (in considerable quantity), that have been found to possess all the febrifuge qualities of cinchona and its derivatives.

NORWAY will send to the Paris Exhibition some fish skins tanned for gloves, eel skins prepared for harness, shark skins over 10 feet long and 3 wide, and whale skins nearly 60 feet long, for driving bands.

PROFESSOR SIR WYVILLE THOMSON has been created a Knight of the Royal Order of the Polar Star by the King of Sweden.

Inventions Patented in England by Americans.

From December 18 to December 28, inclusive.

BERTHS.—Chas. Emery, Boston, Mass.
BOXES FOR TOBACCO, ETC.—W. L. Hubbell *et al.*, New York city.
BRAKE MECHANISM.—A. F. Gue *et al.*, Boston, Mass.
CABINET DESK.—Joseph A. Moore, Indianapolis, Ind.
CAR COUPLING.—Frank Gibford, Newton, Iowa.
DRAFT REGULATOR.—R. F. Hyde, Springfield, Mass.
FARE CHECK.—Geo. Beadle, Syracuse, N. Y.
FIREARM.—D. B. Wesson, Springfield, Mass.
FURNACES FOR STEAM BOILERS.—R. K. McMurray, New York city.
GEOGRAPHICAL CLOCK.—W. A. Cates, Union, Oregon.
HOT AIR FURNACE.—W. F. Nast, St. Louis, Mo.
MAGNETO-ELECTRIC MACHINE.—Edward Weston, Newark, N. J.
PUNCHING AND SHEARING MACHINE.—David Brickner, New York city.
RAILWAY SWITCH AND SIGNAL.—Joseph S. Williams, Riverton, N. J.
REAPER AND GRAIN STRAW BINDER.—W. A. Wood, Hoosic Falls, N.Y.
SIREN FOG SIGNAL.—Felix Brown, New York city.
STEAM GENERATOR.—Chas. Tyson, Philadelphia, Pa.
TELEGRAPH CABLE.—David Brooks, Philadelphia, Pa.

© 1878 SCIENTIFIC AMERICAN, INC

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

An Engineer and Machinist of 20 years' experience, the last ten as Manager of a large establishment, desires to engage in the same capacity with some reliable manufacturing establishment. Address "Engineer," Box 938, Nashua, N. H.

For Power & Economy, Alcott's Turbine, Mt. Holly, N.J.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

An active, healthy, strong and intelligent young man desires a situation with a Civil Engineer or Surveyor; fair education; good abilities. Address Chas. L. Sullivan, 26 Pratt Place, Chicago, Ill.

For book on Lubricants, R. J. Chard, 134 M. Lane, N.Y.

Having dissolved partnership July 1, 1877, we have still on hand and for sale, a very large amount of new and 2d hand machines. See our notice on page 93. Steptoe, McFarlan & Co., Cincinnati, Ohio.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

I have a perfect Liquid Waterproof, transparent or colored, for any surface. Address P. O. Box 5405, N.Y.

Scroll Saw Designs. Send for illustrations and price lists. A. W. Morton, 104 John St., N. Y.

A situation wanted by an experienced Pattern Maker. Address H. A. Chase, Lee, Mass.

Assays of Ores, Analyses of Minerals, Waters, Commercial Articles, etc. Technical formulæ and processes. Laboratory 33 Park Row, N. Y. Fuller & Stillman.

The best Steam Trap now on the market sold by W. E. Kelly & Bro., 46 Cortlandt St., N. Y.

For Sale.—Machinery and Compositions of all kinds of Matches. Apply to J. H., P. O. Box 942, N. Y. city.

Canadian Patent For Sale.—Mey's Dryer for Grain, Malt, etc., has been in practical use for several years in Buffalo, N Y. Address F. H. C. Mey, Buffalo, N. Y.

For a 15 in. Swing Lathe having 1⅝ in. hole through Head Spindle, something new, address Star Tool Company, Providence, R. I.

Carpenters.—Your Saws will cut straight by using my Jointer; the teeth will all be of an equal length. Sample by mail, 25 cts.; $2 per doz. E. Roth, New Oxford, Pa. I want agents.

2d Hand Iron Planer built by Smith of Salem. Plane 13 ft. x 30 in.; price $375. A. C. Stebbins, Worcester, Mass.

Cornice Brakes. J. M. Robinson & Co., Cincinnati, O.

Noise-Quieting Nozzles for Locomotives, Steamboats, etc. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Shaw's Mercury Gauges, U. S. Standard of Pressure. 915 Ridge Ave., Philadelphia, Pa.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Vertical Scientific Grain Mills. A. W. Straub & Co., Phila.

Corliss Engine Builders, with Wetherill's improvements, Engineers, Machinists, Iron Founders, and Boiler Makers. Robt. Wetherill & Co., Chester, Pa.

The Turbine Wheel made by Risdon & Co., Mt. Holly, N. J., gave the best results at Centennial test.

Best Machinists' Tools. Pratt & Whitney, Hartford, Ct.

Lansdell & Leng's Lever and Cam Gate Valves. Cheapest and best. Leng & Ogden, 212 Pearl St., N. Y.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

Electrical Goods of every description, Annunciators, Bells, Batteries, Wire, Electro-plating Apparatus, etc. Finger, Risteen & Co., Melrose, Mass.

Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 94.

For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B.C. Machinery Co., Battle Creek, Mich.

Alcott's Turbine received the Centennial Medal.

Wanted.—A new Horizontal Slide Valve Engine, cylinder 18 inches, diameter 30 to 36 inches stroke. Address, with detailed description and lowest cash price, Box 1597, Philadelphia P. O.

The Niles Tool Works, Hamilton, O., have second-hand Machine Tools in first class order for sale.

Friction Clutches warranted to drive Circular Log Saws direct on the arbor; can be stopped instantly; also Upright Mill Spindles, Safety Elevators, and Hoisting Machinery. D. Frisbie & Co., New Haven, Conn.

Wanted.—Second-hand Gun Stocking, and other Gun Machinery. Address V. A. King, Lock Box 81, New Haven, Conn.

For Extra Tempered Springs for Machinery, Sewing Machines, Locks, and all special purposes, address C. T. Schoen, Wilmington, Del.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Wanted.—A purchaser for Patentable Inventions. W. R. W., Lincolnton, N. C.

The "Niles Engine" is eminently well suited for all purposes requiring an engine from 2 to 12 horse power. The boiler and engine are both erected on the same substantial and ornamental base, but are otherwise not connected except by the necessary piping. They are complete power outfits, and are strictly first class in design, material, and workmanship. Address Niles Tool Works, Hamilton, Ohio.

Wanted.—Makers of Improved Wood-working Machinery and Rice Cleaning Machinery to send particulars and prices to J. M. Lyon, Singapore, via China.

$5 to $50 per day to Agents. D.L.R.Co., Londale, R.I.

Vertical & Yacht Engines. N.W.Twiss, New Haven, Ct.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

Bound Volumes of the Scientific American.—I have on hand about 200 bound volumes of the Scientific American, which I will sell (singly or together) at $1 each, to be sent by express. See advertisement on page 93. John Edwards, P. O. Box 773, N. Y.

Notes & Queries

(1) G. O. A. writes: Is there a practical bicycle made at present; that is, one which would enable a man of ordinary muscular development to travel a distance of 20 miles on a good country road in less time and with less fatigue than he could do it on foot? A. We think it is doubtful, but would be glad to hear from correspondents who can contribute items drawn from personal experience.

(2) M. P. F., writing from Edinburgh, is anxious to obtain information as to the progress in building steam yachts in America, and asks (1) for plans and estimates, particularly of boilers? A. We have published particulars of a number in the SCIENTIFIC AMERICAN and the SUPPLEMENT. 2. I have a pair of engines, cylinder 5 inches in diameter, 6 inches stroke, with a return tubular boiler, working pressure 100 lbs. Please give me your advice as to size of boat for the above, to get at least 12 knots an hour in smooth water? A. Make a boat about 25 feet long. 3. What size and form of propeller would you recommend? A. As great diameter as possible, 3½ to 4 feet pitch.

What are the proportions of a hard white alloy? A. Sheet brass, 32 parts; lead, 2; tin, 2; zinc, 2; by weight.

(3) G. G. asks whether there is any way of making soft castings out of hard iron, or any mode of reducing the hardness in the process of melting? A. No.

(4) A. Y. asks: Are there maps printed or stamped on leather? A. We do not know of any.

What will produce luster on block tin? I use it to coat the inside of cast hollow ware, and I find that some brands dull down too much in cooling? A. Put a little resin on the ware.

(5) R. H. E. writes: I wish to become an aeronaut, but my means are limited and I know of no professional to address upon the subject. Would it be practicable for me to construct a balloon and use it without the aid of a regular aeronaut? What would be the dimensions and cost of one capable of carrying one man? A. See SCIENTIFIC AMERICAN, vol. 32, p. 64.

(6) T. C. asks whether it would be necessary to protect from internal corrosion a boiler having a pipe condenser made of galvanized iron pipe and using fresh water, by coating inside with "salt scale?" A. When such condensers are used it is advisable to coat the interior of the boiler with a thin scale.

(7) J. C. W. asks: 1. Which of the two boilers, both built the same, one of ¼ inch and the other ⅜ inch iron, will stand the most pressure of steam? A. The latter. 2. In a compound engine, does the steam exhaust direct from the high pressure cylinder into the low? A. In some forms it does; more commonly a receiver is employed. 3. Are the pistons of a marine engine the same as those of a stationary engine? A. Yes.

(8) H. H. C. inquires: 1. Can a young man eighteen years of age, with a common education, go on a locomotive as fireman and work himself up to engineer, and what would be the best way for him to proceed? A. Generally shop experience is requisite. 2. What is the average cost per year for locomotive repairs on our largest roads: those that run daily? A. It averages from 5 to 7 cents per mile run.

(9) A. T. V. asks: 1. In Bell's telephone how thick is the soft iron disk? A. $\frac{1}{100}$th of an inch. 2. Where is it obtained? A. At any photographic establishment. 3. How much insulated copper wire does it take, and of what size? A. Two ozs. of No. 40 for each spool. 4. Does the large wire have to be insulated? A. No. 5. Using illustrations of Bell's telephone, would a person have the right to make one strictly for own use? A. No.

(10) W. A. asks: How can I best cast small small quantities of brass; that is, what will be my cheapest way of melting it? A. You can obtain sufficient heat at a blacksmith's forge. Use a plumber's crucible.

(11) O. M. asks: Will it injure an emery wheel to use water in grinding? A. Ordinarily, yes. There are emery wheels with which water can be used.

(12) M. J. B. inquires the method of calculating the angle of convergence of meridians and the true way of running out a parallel of latitude? A. Consult some standard work on surveying.

(13) U. C. asks: In running a 4 x 5 inch cylinder engine at 200 turns per minute, with 50 lbs. steam pressure, I should exhaust into an iron tank having a capacity of 4 cubic feet, and allow the exhaust steam to escape from the tank under a pressure of 3 lbs. to the inch on the tank. What would be the temperature of the exhaust steam in the tank? A. About 222° Fah.

(14) P. D. H. writes: Would you be good enough to give me a formula to find the size of a feed pump for a boiler of a given dimension? A. Knowing the speed of the pump and the volume of water it must deliver per hour, multiply this volume by 2; then it is required that diameter of plunger in feet × stroke in feet × strokes per hour = cubic feet of water required per hour × 2. Now assume either the diameter or the stroke, and the other dimension can be determined from the above equation.

(15) V. P. K. writes: I have just built a kiln for drying grain, 9 x 9 feet inside, 47 feet high, with six floors or nether pans. There is a coal fire in the basement, the gases passing up around the pans. Since the Barclay street explosion the question has been: Is there any danger in entering the kiln with a light? The gas does not prevent the workmen from remaining within the kiln without difficulty. A. As we understand the arrangement, there does not seem to be any danger in the use of a light, but by employing a safety lamp you can settle the matter beyond question.

(16) H. B. asks: Will a railroad train stop quicker when the brakes are put on hard enough to stop the wheels from turning, so that they slide on the rail, or will the train be brought to a standstill, quicker by putting the brakes on so that the wheels can still turn a little under it? A. In the latter way.

(17) D. W. L. writes: I have a boat 21 feet long and 4 feet 6 inches beam, with a horizontal boiler 48 inches long and 33 inches diameter. Which would drive the boat the faster, a double engine with two 3 x 3 cylinders, or a single 4 x 4 inch cylinder, and what size propeller would I need? A. For the same number of revolutions per minute, the single engine will give the most power. Use a screw with as large diameter as possible, and 3 feet pitch.

(18) H. E. G. asks: 1. Please give me a simple method for raising tall smokestacks and setting them up in the boilers? A. The most convenient way is to rig up shears and to hoist the stack into position. 2. Please explain the use of the air pump on condensing engines? A. It removes the air and vapor from the condenser. 3. What is meant by superheated steam? A. Steam which has a temperature greater than is due to the pressure.

(19) E. A. J. asks: How does the water in a 2-flue boiler, under a pressure of 120 lbs. to the inch, stand? A. At about 350° Fah.

(20) P. O. writes: I propose having a pair of high pressure stationary engines built for hoisting out of a mine, one third more power than I want to work on one shaft—cylinders 20 x 48, 60 lbs. steam, to cut off at half stroke. Which will be the most economical way of running them, 20 strokes per minute, or 40? A. The latter, as we understand your question.

(21) S. B. B. writes: We have a coil heater with 60 feet of 2 inch heavy pipe bent. The pump forces the water through the coil to the boiler, and when the water leaves the coil it shows 212°. Now, if we put in a second coil of 1¼ inch pipe, 70 feet long, and run the water through it first and to the pump admitting it, to come out of the 1¼ at 212° before it enters the 2 inch, what will we gain by it? There is a dispute about the question which we ask you to settle. I think we gain nothing. A. We think you have the right idea.

(22) E. M. S. writes: In drilling holes for blasting purposes, would any advantage be gained by enlarging a hole at the bottom for the purpose of giving the explosive a more distinct bearing? An ordinary drill will make a straight hole, while the drill I have in my mind will make a hole expanding at the bottom, giving a bearing which cannot be had by using an ordinary drill, and as far as I am able to see, the same amount of explosive will do more work. Is this the case? A. We think it is doubtful whether any material advantage will be derived by the proposed method; but of course it can only be definitely settled by experiment.

(23) J. E. C. asks: How much head will a ¾ inch stream require to raise the same amount of water 25 feet, using the most improved water wheel? A. About 42 feet.

(24) F. T. asks: What can I do to mellow a soil that is of a stiff clayey nature? A. Plow it up as roughly as possible, so that the frost may penetrate it.

(25) O. W. asks: How can I anneal brass wire to prevent its breaking when used to make rivets? A. Heat it to a dark red and quench it in salt water.

(26) J. J. says: I am making some forgings with dies under a small steam hammer, and the scale hammers into the skin so that they are difficult to turn in the lathe. Can you suggest a remedy? A. After the forging is finished heat it to a low red heat and file off the scale with a coarse half round file.

(27) B. S. says: I have some fuchsias which I desire to bloom about the middle of May. How shall I treat them to make them bushy plants? A. Put the fuchsias, pots and all, in a damp place sufficiently protected to prevent their freezing, and let them remain there in the dark, if convenient, until about the middle of March. Then re-pot them, water freely, and cut off the stems to about three inches above the mould. Pinch the ends off the first shoots when they are 6 inches long.

(28) R. R. says: What is the best mould to strike slips of plants in, and at what temperature should the atmosphere be kept for them at this time of year? A. Strike them in pure sand, such as builders' sand. Keep well moist and at a temperature of about 50° Fah.

(29) R. J. says: I have made a small hydraulic pump, and when it is under pressure the water oozes clear through the cast iron cylinder. How can I prevent this? A. Take a ball pened hammer and pene the casting all over on the outside. This will close the pores and stop the oozing.

(30) F. K. asks: What is the addendum of a gear wheel? A. The height of the tooth beyond the pitch line.

(31) W. H. H. G. says: If S. M. B. (49) will leave off one pair socks and put a very little red pepper in the toe of each boot he will need to complain no more. Cotton socks if his feet sweat.

(32) E. T. W. asks: Will you, to settle a controversy, please define what lightning is? A. It is the name of the discharge, accompanied by light, of a large quantity of static electricity, produced by the action of Nature.

(33) D. F. F. says: The sulphur from our refinery is brittle, and in order to prevent loss in shipping we are obliged to pack it in bags or boxes. Is there any simple process by which it may be hardened sufficiently to admit of shipping in bulk, loose? A. The sulphur will be somewhat less brittle if re-heated for a short time at a temperature of 470° Fah., and cooled as quickly as possible. If sulphur at this temperature is run directly into water, it assumes the tough, flexible allotropic condition, which, after some time, resumes the yellow crystalline character.

Can we convey water 2 miles in a ½ or ¾ inch iron pipe up and down hill—from a spring to our works—spring being 1,000 feet above works? A. The loss of flow by friction in such a line would be very considerable and subject to frequent interruption from the accumulation of air in the elevated portions to be tapped.

(34) N. R. S. writes: 1. In your issue of September 22, under the head of "Electro-Silicic Light," you allude to secondary couples. Will you oblige an uninformed reader by describing the mode of constructing such couples? A. See SUPPLEMENT No. 5, p. 65. 2. Will you also kindly inform me in what book or books I can obtain the best history in detail of the more famous electro-motors? A. We do not know of any work especially devoted to this subject; each step in this direction is described in our columns. See p. 184 of the issue of SCIENTIFIC AMERICAN of September 22, 1877.

(35) J. M. asks: How is a steam engine started when the crank is at its dead point? A. By moving the crank over the center by muscular power, applied in any way that is convenient and safe.

How is a copper wire insulated? A. By winding the wire with cotton or silk, or coating it with a non-conductor, such as shellac or rubber or gutta percha, or any way in which the wire is separated from different parts of its own length, or from other conductors by a non-conductor.

(36) F. P. writes: How can I make an electric bell ring as follows: I want to wind a copper or gold wire around a thin rubber tube a few times, and use this so that the bell will be made to ring by electricity when the rubber tube is blown full of air, thereby causing the tube to expand quite hard against the wire. A. Allow one end of the wire that is wrapped on the rubber tube to project, so that when the tube is expanded by the air, this projecting end will move. Then connect one binding post of your electric bell with the other end of this wire, and connect the other binding post of the bell with one pole of the battery; the other pole of the battery must be connected with a metallic point, so that when this projecting end moves it will touch the metallic point, and thereby close the electric circuit and cause the bell to ring.

1. Has there ever been a practical engine invented that has only one steam chest and yet cannot be dead-centered? A. None that have been generally considered practically useful. 2. Can steam be used again after it has passed through the cylinder? A. Yes. 3. Could it be used in another cylinder? A. Yes. 4. Would it perform the same amount of work as in the first cylinder? A. That will depend on the pressure of the steam and the size of the first cylinder, also as to whether the steam is used in the second cylinder expansively or by condensation. See our issue of the SCIENTIFIC AMERICAN, September 29, 1877, p. 191.

(37) K., Mo., asks: Is the iron plate which composes the diaphragm of the mouthpiece of a telephone soft iron or hard iron, and also how thick is it? A. The diaphragm is made of rather hard iron, and is $\frac{1}{100}$th of an inch thick.

Where will sound proceeding from a stage be best propagated, in a building with a smooth interior, without ornaments, etc., or in one with ornaments and galleries? A. The one without ornaments.

(38) C. H. C. asks if there is any way to harden an iron casting without warping the face after the surface has been pened? A. No.

(39) M. A. P. & Co. ask for information relative to the ornamentation of glass by the sand blast? A. Sand driven by an air blast of the pressure of 4 inches of water will completely grind or depolish the surface of glass in ten seconds. If the glass is covered by a stencil of paper or lace, or by a design drawn in any tough elastic substance, such as half-dried oil, paint, or gum, a picture will be engraved on the surface. Photographic copies in bichromated gelatin from delicate line engravings have been thus faithfully reproduced on glass. In photographic pictures in gelatin, taken from Nature, the lights and shadows produce films of gelatin of different degrees of thickness. A carefully regulated sand blast will act upon the glass beneath these films more or less powerfully, in proportion to the thickness of the films, and the gradations of light and shade are thus produced on the glass. In the apparatus used air rises through a curved tube, carrying the sand up with it, which is thrown into the air tube by an endless belt of scoops arranged in the lower part of the angular box. The sand is carried up by the air and brought over and down the front air tube, where it discharges with great force upon the surface of the glass, which is contained within the front box and is carried by a belt gradually forward under the blast.

(40) C. C. asks: 1. What metal or mixture of metals should be used for making wiped joints on lead pipes? A. Use ordinary soft solder, 1 part lead, 1 tin. 2. What is the black paint composed of with which the parts near the joint are painted before the joint is made? A. Zinc dissolved in muriatic acid is often used.

(41) A. L. S. asks: What would you consider the horse power of an engine whose dimensions are as follows: Diameter of cylinder, 6 inches; length of stroke, 17 inches; number of revolutions, 125; of pounds' pressure, 80; cutting off at ¾ stroke? A. About 18 horse power, effective.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

W. A. M.—No. 1 is trap containing pyrites. No. 2.—The sample is quite rich in copper—calcopyrite, copper glance, etc.—and lead sulphide. The ore is probably

© 1878 SCIENTIFIC AMERICAN, INC

silver bearing. No. 3 is titaniferous iron. No. 4 is spathic hornblendic schist, possibly adjoining metaliferous films. No. 5 is a fine sandstone, or sandstone conglomerate containing lignite.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose, subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small advertisement in the column specified, by parties able to supply their wants:

What will it cost to erect a factory to condense milk of from 200 to 300 cows?

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Weeks Ending

Dec. 25, 1877, and Jan. 1, 1878,

AND BEARING THOSE DATES.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Advertising brick, G. McMullen ... 198,651
Alkali from solutions, recovering, M. Nixon ... 198,671
Ammonia soda manufacture, E. Solvay ... 198,699
Ash sifter, J. W. Littlefield ... 198,518
Auger, earth, C. D. Pierce (r) ... 8,016
Bale tie, J. M. Goldsmith ... 198,603
Bank check, T. G. Hillhouse ... 198,513
Basket, J. W. Sickler ... 198,696
Bed bottom, A. Lombart ... 198,546
Bed bottom, T. J. Pettit ... 198,676
Bedstead fastening, G. Luppert ... 198,689
Beefsteak pounder, Hill & Thurston ... 198,459
Beer, birch, J. J. Rogers ... 198,467
Belting, tubular, W. M. Deutsch ... 198,451
Binder, temporary, P. C. Clausen ... 198,570
Blotting pad and ruler, W. H. Bennett ... 198,560
Blow pipe, T. Fletcher ... 198,593
Book rest, W. W. & L. W. Liles ... 198,634
Boot and shoe counters, shaping, G. F. Moore ... 198,550
Boot and shoe counters, Moore & Hurlbut ... 198,551
Boot and shoe nail setting, L. Farnsworth ... 198,590
Boot and shoe shank burnisher, J. Woodley ... 198,722
Boot and shoe shanks, making, J. M. Watson ... 198,525
Bottle, table salt, H. J. White ... 198,551
Bottled liquids, transporting, G. Wilson (r) ... 8,011
Box for books, E. K. Burke ... 198,565
Brake lever, wagon, J. W. Anderson (r) ... 8,006
Brakes, coupling for vacuum, F. W. Eames ... 198,584
Brick kiln, C. F. Peck ... 198,673
Brick machine, C. W. Eastwood ... 198,585
Bridge, thorough brace, J. P. Derr ... 198,580
Broom support, G. Uibel ... 198,714
Brush, Burtnett & Cook ... 198,567
Burglar alarm, electric, J. Young ... 198,529
Burial case, Baur & Grom ... 198,531
Butter carrier, refrigerating, S. D. Byram ... 198,568
Cages, cup for animal, O. Lindemann (r) ... 8,018
Can, metal, Miller & Coll ... 198,658
Can or vessel, metallic, C. P. Maxfield (r) ... 8,015
Candlestick, F. R. & A. P. Minard ... 198,660
Car coupling, G. W. Putnam ... 198,680
Car coupling, D. W. Shockley ... 198,695
Car, metallic, B. J. LaMothe ... 198,631
Car roof, Burridge & Barnes ... 198,566
Car wheel, Sax & Kear (r) ... 8,017
Car wheel, Scheibel *et al* ... 198,691
Carbureter, H. W. Merritt ... 198,731
Carbureters, regulated valve, H. W. Merritt ... 198,657
Carpet beating, J. P. Prentiss ... 198,679
Carpet fabric, A. Heald ... 198,615
Carriage curtain, D. W. Copeland ... 198,573
Casting wheels, T. Taylor ... 198,707
Chain machine, L. M. Rumsey ... 198,690
Chair, nursery, A. P. Freshman ... 198,491
Chair, tilting, D. C. Meeker ... 198,655
Churn, reciprocating, T. J. Murphy ... 198,665
Cider mill, J. Weed ... 198,476
Clock, illuminated dial, H. J. & W. D. Davies ... 198,577
Cloth-finishing machine, Leach & Allen ... 198,463
Coal-mining machine, J. W. Harrison ... 198,610
Coat hanger, T. Donohoe ... 198,582
Cock attachment, stop, Denniston & Simmons ... 198,579
Cock, cylinder, G. M. Weinman ... 198,526
Coin holder, H. E. Dewey ... 198,536
Corset, L. H. Foy ... 198,597
Couches, head section for, C. Raabe ... 198,681
Cranberry gatherer, L. L. & D. Lumbert ... 198,641
Crane, traveling, T. A. Weston ... 198,718
Cultivator, R. T. Bowne ... 198,563
Cultivator, J. Higgins ... 198,616
Cultivator, J. S. Johnston *et al* ... 198,624
Cultivator, R. H. Slifer ... 198,698
Cultivator, revolving, J. Graner ... 198,540
Curtain fixture, W. W. Pickford ... 198,677
Curtain fixture, H. T. Raeke ... 198,682
Door check, W. Von Auer ... 198,553
Drawers, suspensory, M. Krickl ... 198,516
Engine, reciprocating, J. Davies ... 198,535
Excavator, J. A. Ball ... 198,445
Fare register, W. Daniels (r) ... 8,019
Fare register, W. H. Hornum (r) ... 8,013, 8,014
Fence, D. E. Lupold ... 198,640
Fence post, A. Shaffer ... 198,694
Fence post, metal, B. T. Frederick ... 198,598
Fence wire, barbed, H. M. Rose ... 198,688
Filter, atmospheric, R. C. Ludlow ... 198,637
Fire escape, G. W. McKee ... 198,649
Fire escape, W. H. Fack ... 198,499
Fire escape, Whaley & Hassler ... 198,720
Fire kindler, W. J. Boda ... 198,562
Fracture apparatus, J. T. Woods ... 198,723
Fruit basket, L. W. Beecher ... 198,446
Fruit jar, T. F. Woodward ... 198,528
Fur from hides, separating, S. M. Ball ... 198,558
Furnace for steam boilers, Eggers *et al* ... 198,587
Furnace grate, T. R. Butman ... 198,487
Furnace, gas, W. L. McNair ... 198,653
Furnace, reverberating, J. Morrison ... 198,661
Furnaces, supplying air to, H. F. Hayden ... 198,613
Gas, making, Aiken & Young ... 198,725
Gate, S. W. Erwin ... 198,588
Gig saddle, J. M. Gwinnell ... 198,609
Glass pot, G. Kim ... 198,628
Governor for steam engines, E. Towns ... 198,711
Grain drills, feed for, A. J Martin ... 198,495
Grain winnower, J. W. Johnson ... 198,623
Guitars, tail piece for, J. Abraham ... 198,556
Gun lock, Nichols & Livingston ... 198,669
Guns, breech-loading, Nichols & Livingston ... 198,670
Harness check rein, A. P. Mason ... 198,644
Harness saddle, A. Gilliam ... 198,510, 198,511
Harness saddle, J. M. Gwinnell ... 198,608
Harness saddle tree, J. Huber ... 198,619
Harrow, C. Du Perow ... 198,538
Harrow, F. A. Hill ... 198,512
Harrow, Tolle & Wirth ... 198,710
Harrow, W. T. Wertman ... 198,716
Harvester and thrasher, Rice & Hoult ... 198,522
Harvester rake, J. Pagin ... 198,520
Hay and grain unloader, R. Cowden ... 198,574
Hinge for shutters, etc., spring, T. Duffy ... 198,452
Hinge, spring, J. Brewer ... 198,533
Hitching device, C. H. Bear ... 198,559
Hog feeder, S. Bryan ... 198,564
Hoisting apparatus, W. W. Carlile ... 198,506
Honey comb, foundation, A. E. McConnell ... 198,648
Hook, lacing, E. Maynz ... 198,646
Horse collars, blank for, L. & J. W. Deming ... 198,578
Horse toe weight, P. G. Olds ... 198,498
Horseshoe, A. L. Lincoln ... 198,635
Horseshoe nails, cutting, J. A. Huggett ... 198,543
Horseshoes, making, J. D. Billings ... 198,448
Hose coupling, Manville & Bissett ... 198,643
Hose nozzle, J. H. Johnson ... 198,515
Hydraulic jack and press, F. G. Hunter ... 198,620
Ice, covering roads with, F. Byron ... 198,569
Ice creeper, J. J. Lewis ... 198,492
Implement, compound, W. H. Sprague ... 198,524
Indicator, T. E. Barrow ... 198,483
Journal, compensating, G. D. Kempton ... 198,626
Label for cigars, G. W. Yerby ... 198,724
Labels, show cards, etc., W. C. Macbrair ... 198,642
Labeling machine, H. B. Smith ... 198,700
Ladder, fire escape, A. d'Amore ... 198,576
Lamp, J. Funck ... 198,660
Lamp, J. D. Lane ... 198,632
Lamp, D. Seawright ... 198,500
Lamp burner, C. C. Richmond ... 198,683
Lamp burner, R. Whetherill ... 198,719
Latch for doors, F. D. Robinson (r) ... 8,008
Latch, reversible, W. E. Sparks ... 198,704
Leather crimping machine, S. W. Jamison ... 198,622
Leather rolling machine, A. F. Stowe ... 198,473
Lifting jack, L. Meeker ... 198,654, 198,656
Lightning rod, C. H. Smith ... 198,471
Lock, time, E. J. Woolley ... 198,721
Logwood, grinding, C. P. Hayes ... 198,614
Loom mechanism, I. L. Wilbur ... 198,555
Lubricating compound, G. G. Munger ... 198,664
Magnifying glasses, stand for, L. Heath ... 198,542
Mandrel, expanding, C. W. LeCount ... 198,633
Mandrel, J. Murphy ... 198,497
Martingale ring, W. Courtenay ... 198,534
Matches, stamps, etc., holder for, C. Scofield ... 198,692
Measuring apparatus for seed heaters, E. S. Taylor ... 198,706
Measuring device for seed bag fillers, W. Blake ... 198,532
Microscopes, stage for, E. Gundlach ... 198,607
Milk cooling apparatus, W. Dripps ... 198,537
Millstone bail, A. H. Kirk ... 198,732
Mitering machine, Strong & Garretson ... 198,472
Moulder's flask and its accessories, H. L. Eames ... 198,490
Moulding machine, T. F. Hammer (r) ... 8,007
Mosquito net frame, Metz & Mader ... 198,465
Motor, Joute & Bernard ... 198,461
Motor, G. W. Wilson ... 198,480
Mower, W. F. Goodwin ... 198,604
Mower, lawn, E. P. Terrell ... 198,708
Nut cracker and pick, S. Poole ... 198,678
Nut lock, E. Reese ... 198,521
Nutmeg grater, J. R. Hughes ... 198,730
Notation, phonetic and diacritical, N. E. Dawson ... 198,507
Oatmeal cutter, H. Z. Coles ... 198,571
Oil wells, packed casing head for, J. Conlan ... 198,489
Ore crusher, T. A. Blake ... 198,561
Padlock, J. J. Turner ... 198,713
Padlock, combination, T. Fox ... 198,595, 198,596
Pantaloons protector, F. G. Hoffmann ... 198,460
Paper boards, lining, J. F. & M. Seiberling ... 198,469
Paper cutting machine, J. G. Morgan ... 198,519
Paper feeding machine, L. Morgenthau ... 198,662
Pavement, S. E. Gross ... 198,606
Pavement, tessellated or mosaic, M. F. Lyons ... 198,638
Pen, fountain, W. S. Briggs ... 198,484
Piano support, J. Fairman ... 198,727
Pictures, device for hanging, W. D. Smith ... 198,703
Pipe and tube coupling, W. H. Butler ... 198,726
Pipe, machine for jointing, M. W. House ... 198,729
Plaiting machine, C. S. Caple ... 198,488
Planter attachment, corn, W. W. S. Kime ... 198,629
Planter, corn and cotton, C. Domschke ... 198,581
Planters, marker for corn, C. M. Hoghton ... 198,514
Plow, steam, S. P. Goddard ... 198,601
Plow, swivel, J. Hartmann ... 198,611
Pocket protector, J. Koehler ... 198,545
Post hole and well auger, L. M. Lee ... 198,517
Printing machine, rotary, W. F. Widmayer, 198,479, 198,502
Pulley attachment for gaffs, H. Loud ... 198,636
Pulley block, E. R. Wethered ... 198,527
Railway cross tie, D. Horrie ... 198,618
Railway cross tie, E. E. Lewis ... 198,464
Railway signal, W. Buchanan ... 198,449
Railway signals, closer for, J. I. Conklin, Jr ... 198,572
Ranges, hot water tank coupling, N. M. Simonds ... 198,697
Razor strop, J. S. Fisher ... 198,592
Refrigerator, E. R. Olin ... 198,466
Rein holder, L. Pentz ... 198,674
Road scraper, S. J. Hayes ... 198,541
Rock drilling machine, F. Keenan ... 198,625
Rock drills chuck for, P. S. Buckminster ... 198,486
Rock drills, clamp for, P. S. Buckminster ... 198,485
Rolling iron, F. Nevergold ... 198,667
Roundabout, F. Millward ... 198,659
Rubber, cutting, T. A. Richards ... 198,684
Sad iron, O. Avery, Jr ... 198,530
Sand pump reel, M. B. McManus ... 198,652
Sash balance, W. Milner ... 198,548
Saw gauge, F. T. Grogan ... 198,458
Saw handle, cross cut, Moss & Abbott ... 198,663
Scales, weighing, C. L. Crowell ... 198,575
Sewing machine, darning attachment, Y. M. Rose ... 198,687
Sewing machine shuttle, C. A. Schumacher ... 198,693
Sewing machine, wax thread, H. Folsom ... 198,594
Sewing machine, N. D. Stoops ... 198,705
Shafting, etc., cylindrical coupling for, T. Dowling ... 198,508
Shelf, portable folding, A. C. French ... 198,454
Ship's rigging, fair leader for, J. Betts ... 198,447
Shoe, A. G. Colby ... 198,450
Shoulder brace, M. Altmann ... 198,503
Shutter fastener D. Ward ... 198,715
Shutter worker, H. Smidt ... 198,470
Sirups, manufacture of, B. S. Toothill ... 198,474
Skirt and hose suspenders, L. Z. Hitchcock ... 198,617
Skylight, self ventilating, P. F. Kirk ... 198,462
Slate, C. C. Shepherd ... 198,552
Sleigh knee, metallic, P. Filman ... 198,591
Snow plow, G. Royal ... 198,468
Spark arrester for steam boilers, T. W. Godwin ... 198,602
Stamp, steam, J. B. Ellenbecker ... 198,509
Standards, support for upright, J. Warner (r) ... 8,010
Steel, butcher's, W. T. Nicholson ... 198,668
Stench trap, Grim & Low ... 198,457
Stench trap, F. W. Volkman ... 198,501
Stirrup, H. H. Knight ... 198,630
Stove, gas, McKinley & True ... 198,650
Swing, Hartman & Freese ... 198,612
Tag fastener, E. A. G. Roulstone ... 198,689
Tanning leather, I. Wells ... 198,477
Tanning leather, extract for, I. Wells ... 198,478
Telegraph relay, electric, Allan & Brown ... 198,482
Tellurian, G. McBride ... 198,647
Tent, J. C. French ... 198,599
Thill tug, J. T. Smith ... 198,702
Tombstones, covering for, E. F. Towers ... 198,712
Toy portrait gallery, D. C. Fabronius ... 198,589
Tree protector, D. P. Mathews (r) ... 8,012
Tree protector, A. S. Smith ... 198,701
Truck, transformable stove, B. Slemmons ... 198,523
Truss, E. Edel ... 198,586
Tubing, machine for lining, H. Meyer ... 198,547
Type case, J. Ropes ... 198,686
Umbrella covers, clasp tip for, J. C. Hurcombe ... 198,621
Umbrellas, notch ring for, A. Milliken ... 198,549
Undersuit, C. L. Bradley ... 198,505
Vehicle draft attachment, M. D. Nelon ... 198,666
Vehicle running gear, A. Graham ... 198,455
Vehicle shade, Andrus & Hammond ... 198,444
Vehicle spring, E. T. Westerfield ... 198,717
Velocipede, C. C. Kerr ... 198,627
Vent, air pressure fluid, H. B. Park ... 198,672
Vulcanized rubber fabric for belting, J. Murphy ... 198,496
Wash basin, Grim & Low ... 198,456
Washing machine, J. O. Beauperland ... 198,504
Water, etc., apparatus for raising, J. J. Marcais ... 198,645
Water closet, J. H. Peterson ... 198,675
Water meter, piston, G. Fajen ... 198,539
Water wheel, I. Gothard ... 198,728
Welding metal tubes, S. P. M. Tasker (r) ... 8,009
Wells, device for lining, Dunton & Simkins ... 198,583
Wheat cracking machine, Grant & Henry ... 198,605
Wheelbarrow, A. J. Upham ... 198,475
Wheels to shafts, keying, D. A. Woodbury ... 198,481
Windmill, W. H. Evans ... 198,453
Wool washing machine, J. Bachelder ... 198,557
Wrench, G. Kettlewell ... 198,544
Wrench, S. E. Robinson ... 198,685
Wrench, pipe, with cutter, W. E. Thornton ... 198,709
Wringer, M. N. Lovell ... 198,493, 198,494

DESIGNS PATENTED,

10,363 to 10,367.—CARPETS.—J. Campbell, London, Eng.
10,368 to 10,379.—CARPETS.—J. Fisher, New York city.
10,380.—SKATES.—E. H. Barney, Springfield, Mass.
10,381.—PATTERNS FOR WINDMILLS.—G. Neally, New York city.
10,382.—HAT BLOCK.—J. Sealy, Newark, N. J.
10,383.—ARTICLES OF JEWELRY.—J. W. Miller *et al*., Newark, N. J.
10,384.—BOOTS AND SHOES.—J. Pienovi, Newark, N. J.

FOR THE WEEK ENDING JANUARY 1, 1878.

Air-cooling apparatus, A. Albertson ... 198,880
Amalgamator, I. M. Phelps ... 198,904
Auger, H. L. Shaler ... 198,857
Awning, window, J. Cain ... 198,792
Axle, car, W. F. Brooks ... 198,870
Axle coupling, car, C. M. Kimball ... 198,747
Bed bottom, J. Magers ... 198,892
Bed spring, E. C. Barmore ... 198,833
Bedstead, camp, R. A. Bradley ... 198,869
Bedstead fastening, S. D. Butler ... 198,836
Belting machine, L. Starck ... 198,860
Bench dog, Z. Cook ... 198,763
Bending machine, wood, Swartz & Cross ... 198,780
Bird cage feed cup holder, A. B. Hendryx ... 198,846
Boiler feeder, steam, T. W. Mather ... 198,850
Boilers, crown sheet for steam, W. S. Hudson ... 198,743
Boilers, fastening bottoms in, W. H. Cloke ... 198,794
Boilers, feeding water for, S. M. Fulton ... 198,737
Boot and shoe machines, Z. Beaudry ... 198,835
Brake for machinery, safety, A. A. Frecot ... 198,799
Brush, scrubbing, J. M. Wilkinson ... 198,828
Burial vault, portable, J. Chittock ... 198,872
Car coupling, H. J. L. Dette ... 198,736
Car coupling, S. N. Keith ... 198,746
Car coupling, B. Rowell ... 198,903
Car, dumping, D. O'Brien (r) ... 8,021
Car spring, G. F. Godley ... 198,843
Car step register, W. Beeson ... 198,786
Car wheel and lubricator, B. F. Shelabarger ... 198,819
Car windows, screen holder for, E. L. Wallace ... 198,917
Carpet lining, A. Robinson ... 198,816
Carriage knob, G. L. Crandal ... 198,840
Casting metals, mould for, A. J. Nellis ... 198,852
Chair, rocking, T. J. Palmer ... 198,810
Churn, H. T. Davis ... 198,797
Churn, J. A. & W. V. McConnell ... 198,806
Churn, J. G. Taylor ... 198,906
Churn, rotary box, Isbell & Taylor ... 198,802
Clamp, Rockwell & Doty ... 198,754
Commode, S. Whitnum ... 198,865
Condenser, injection, W. H. Guild ... 198,883
Corn sheller, J. W. Fingar ... 198,878
Corset, C. W. Foster ... 198,881
Cotton cleaner, Desha & Manahan ... 198,873
Cradle, L. J. Adams ... 198,784
Cultivators, ridging attachment, H. Parker ... 198,752
Curtain fixture, G. W. Cornell ... 198,839
Dental articulator, H. C. F. Oehlecker ... 198,853
Derrick, portable, A. Meharry ... 198,895
Desk, school, F. T. June ... 198,922
Disintegrating or mixing machine, D. C. Ebaugh ... 198,764
Ditching machine, M. J. Austin ... 198,785
Earth-boring machine, W. H. Yarborough ... 198,911
Engine, hot air, J. B. Ward ... 198,827
Evaporating pan, W. A. Morrison ... 198,900
Fabrics, machine for spreading, W. Birch ... 198,787
Fan, automatic, F. & I. Elkins ... 198,798
Fifth wheel for vehicles, P. Okelund ... 198,809
File handle, W. T. Nicholson ... 198,777
Fire arms, extractor for, Jones & Marston ... 198,745
Fire escape and spring bed, J. G. King ... 198,848
Fish trap, D. S. McBryde ... 198,894
Fishing rod tip, C. R. Fisher ... 198,879
Flour bolt, F. Kruse ... 198,889
Fork, horse hay, S. Chapman ... 198,762
Fruit and hop dryer, W. Butts ... 198,791
Gauge, weather board, W. Z. Marsh ... 198,772
Gas regulator, G. W. Thompson ... 198,862
Gases, recovery of nitrous, Molloy & Warren ... 198,776
Gate, N. B. Cooksey ... 198,838
Gate, P. Smith ... 198,858
Glassware, manufacture of, J. H. Hobbs ... 198,741
Glove, A. C. Butts ... 198,921
Grain binder, C. Colahan ... 198,735
Grain binder, L. Miller ... 198,898, 198,899
Harrow, J. Lennon ... 198,920
Harvester and thrasher, J. Hay ... 198,801
Hat bodies, J. Bigelow ... 198,868
Hats, stretching, R. Eickemeyer ... 198,876
Hats, J. Bigelow ... 198,867
Heater, tubular, E. E. Gold ... 198,766
Hinge, lock, J. B. Stone ... 198,822
Hitching bar, A. L. Andrews ... 198,832
Hoe, hand, W. D. Webster ... 198,910
Hoop machine, barrel, C. W. Thompson ... 198,825
Hops, curing, W. W. Edgarton ... 198,875
Horseshoe, E. L. Tevis ... 198,824
Horseshoes, buffer for, C. Hartmann ... 198,885
Hydrant valve, Stevens & Bond ... 198,756
Ice machine, A. Albertson ... 198,831
Injector, J. D. Lynde ... 198,891
Injector, insect powder, G. N. Milco ... 198,837
Iron and steel manufacture, I. L. Bell ... 198,733
Knitting machine, E. Tiffany ... 198,757
Ladder, A. H. Middleton ... 198,897
Lamp wick measurer and cutter, G. Washington ... 198,864
Land roller, harrow, and drill, S. F. Reynolds ... 198,778
Latch and lock, S. Oppenheimer ... 198,751
Latch, door, T. Percival ... 198,811
Level, spirit, Ward & Bedworth ... 198,909
Lock, combined indicator and seal, E. B. Caton ... 198,837
Lock, hasp, W. D. Spencer ... 198,859
Locomotives, exhaust for, G. S. Brainerd ... 198,789
Loom, vertical, J. M. Flagg ... 198,765
Lubricator, J. Farley ... 198,842
Manure grinder, T. C. Garlington ... 198,882
Meal bin, J. Thickett ... 198,781
Meat tenderer, C. T. Stephens ... 198,755
Microscope, R. B. Tolles ... 198,782, 198,783
Microscopes, object glass for, E. Gundlach ... 198,914
Middlings, separating machine, G. Milbank ... 198,775
Moulded articles, composition for, J. P. Hayden ... 198,884
Moulding machine, H. Reynolds ... 198,856
Musical instrument, mechanical, O. H. Arno ... 198,866
Nail machine, rotary cut, R. C. Grant ... 198,844
Nut lock, A. G. & R. Heinle ... 198,740
Oiler, J. J. Newbaker ... 198,808
Ore roasting apparatus, H. F. Howell ... 198,767
Oven, hot blast, J. M. Smith ... 198,820
Overshoe, rubber, J. A. Olmstead ... 198,901
Padlock, W. P. Yoe ... 198,918
Painting wire cloth, C. H. Waters (r) ... 8,022
Paper box machine, Heyl & Brehmer (r) ... 8,020
Paper, reducing wood to, W. H. Haskins ... 198,845
Paper pulp distributor, I. Jennings ... 198,887
Pearl surfaces, imitation, F. Tuchfarber ... 198,758
Pen, soluble ink, J. Perkins ... 198,812
Pianos, pedal attachment, L. Mathias ... 198,893
Pile for making skelps, D. B. Oliver ... 198,854
Pin, safety, W. A. Butler ... 198,912
Pin, safety, J. P. Lindsay ... 198,890
Pipes, union or joint for, J. Shaw ... 198,818
Planter, corn, G. W. Brown ... 198,760
Planter, corn, Dodge, Jr., & Mast ... 198,874
Plow, W. L. Mathews ... 198,773
Plow, J. M. Payne ... 198,902
Pocket, safety, W. V. Perry ... 198,753
Poke, D. S. & L. W. Ludlum ... 198,805
Press, S. R. Bartlett ... 198,834
Press, cotton, R. C. & J. N. Thompson ... 198,907
Printer's composing stick, H. C. Fenton ... 198,913
Printing surfaces, producing, J. P. Jamison ... 198,847
Printing tickets and recording receipts, B. C. Pole ... 198,855
Pump reel, sand, M. B. McManus ... 198,774
Railway, inclined plane, R. Knudsen ... 198,888
Refrigerator, E. B. Jewett ... 198,768
Reservoir and wash stand, A. D. Lufkin ... 198,770
Rowlock, R. R. & E. Spedden ... 198,821
Sash balance, C. Messenger ... 198,896
Sash-fastener, S. Cole ... 198,795
Sash-fastener, C. Steller ... 198,861
Scales for pasteboard, Fairbanks & Spooner ... 198,877
Scales for weighing, pendulum, N. H. Putney ... 198,815
Scraper, road, J. Fleming ... 198,880
Seeder, broadcast, H. H. Monroe ... 198,750
Sewing machine mechanism, T. K. Keith ... 198,915
Sewing machine mechanism, T. Briggs ... 198,790
Shaft tug, J. & W. B. Miller ... 198,851
Sled runner attachment for vehicles, F. Kuempel ... 198,748
Spark arrester, W. T. Urie ... 198,919
Spark extinguisher, B. V. Crumrine ... 198,796
Spine diseases, machine for treating, M. Case ... 198,871
Spinning mules, Howland & Lawton ... 198,742
Spring hook, G. E. Perrin ... 198,813
Steam generator, water tube, W. P. Trowbridge ... 198,863
Steamer, culinary, H. T. King ... 198,769
Steel, apparatus for tempering, A. Luttges ... 198,804
Stone breaker, S. L. Marsden ... 198,849
Stove pipe expander, H. Imhof ... 198,886
Stoves, P. Symons ... 198,823
Strainer, milk, J. D. Sechler ... 198,905
Stump extractor, I. O. Sailor ... 198,817
Table, folding, G. A. Trimble ... 198,826
Teaching history, etc., N. Loverin ... 198,749
Teeth on aluminum plates, J. T. Thornton ... 198,908
Telegraphy, Morse telephonic, E. Gray ... 198,738
Thill coupling, D. A. Johnson ... 198,803
Thill couplings, H. U. Upjohn ... 198,759
Time recorder, W. E. Phelps ... 198,814
Tobacco, measuring and packing, C. C. Clawson ... 198,794
Trace carrier and buckle, J. T. Gathright ... 198,800
Trough for cattle, S. Johnson ... 198,744
Truck, water carrying, Blackman & Griffing ... 198,784
Turnstile register, B. F. Card ... 198,761
Umbrella, E. Evans ... 198,841
Valve for steam engines, F. B. Rice ... 198,779
Valve for steam engines, R. H. D. Morrison ... 198,916
Whiffletree hook, D. A. Hagan ... 198,739
Whiffletree plate and clevis, H. A. Luttgens ... 198,771
Windmill, A. T. Winehell ... 198,829
Wire cloth, C. H. Waters (r) ... 8,023
Wood receptacle, S. H. Bradford ... 198,788

[A copy of any of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.]

© 1878 SCIENTIFIC AMERICAN, INC

Advertisements.

Inside Page, each insertion ---75 cents a line.
Back Page, each insertion ---- $1.00 a line

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

Bound Volumes

OF THE

Scientific American.

I have on hand the following **bound** Volumes of the SCIENTIFIC AMERICAN (over 200), which I will sell at $1.00 each, either singly or by the quantity.

OLD SERIES.	NEW SERIES.	NEW SERIES.
Vol. 6....4 Copies.	Vol. 1....9 Copies.	Vol. 13. 14 Copies.
" 7..5 "	" 2...11 "	" 14..11 "
" 10...2 "	" 3...7 "	" 15..11 "
" 11....7 "	" 4..10 "	" 16..13 "
" 13....5 "	" 5...3 "	" 20..2 "
" 14....4 "	" 6...4 "	" 21..2 "
	" 7...7 "	" 28..15 "
Vols. of Old Series contain one year's numbers, and the New Series six months.	" 8..8 "	" 32..28 "
	" 9...8 "	
	" 10...14 "	
	" 11...7 "	
	" 12...15 "	

The books will be sent by express on receipt of price.

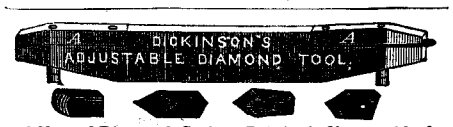
Address, JOHN EDWARDS,
P. O. Box 773, New York.

TELEPHONE Full descript'n how to make, 3 stamps. A. D. Hard 133 Blackstone St., Boston.

WANTED—Men in each State for the Detective Service and to report crime. Pay liberal. Inclose stamp, and address AMERICAN AND EUROPEAN SECRET SERVICE CO., Cincinnati, Ohio.

Improved Slide Valve for Steam Engines.

Fuel saved, power gained. May be adapted to any engine at small cost. Thoroughly tested for seven years. In one case saved $300 monthly in fuel. Circulars free. J. F. TALLANT, Burlington, Iowa.



and Shaped Diamond Carbon Points, indispensable for Trueing Emery Wheels, Grindstones, Hardened Steel and Paper Calendar Rollers, Drilling, Planing, Moulding and Sawing Stone. J. DICKINSON, 64 Nassau St., N. Y.

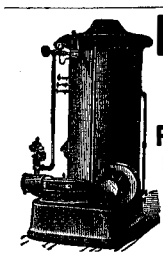
TUNNELS AND ROCK-BORING MACHINERY. By John Darlington. Particulars, Dimensions, and Methods employed in the Mont Cenis, St. Gothard, Hoosac, Sutro, Musconetcong, and Severn Tunnels. Rapidity of Work, Performances and Cost of Various Machines, Amount of Water, Compressed Air, etc., required, and nine illustrations. The Altenberg Zinc Mines, Aix-la-Chapelle; Perseberg Mines, Sweden; Shaft at Salzberg Altenwald; Marie Colliery; Pierre Dennis Pit; Stahlberg Musen, Prussia; Gouley Colliery; Dryrook Iron Mines; Sir Francis Level, Yorkshire; Frederichsegen Wrexam Mineral Mines; Johann Colliery, Prussia; Maesteg Tunnel; Cymbran; Dolcoath; South Crofty, Cornwall; Carn Brea, Cornwall; Ballacorkish, Isle of Man. For each Mine or Tunnel is given the Number of Holes in Heading, Character of Rock, Labor Employed, Time, Cost, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **109.** Price 10 cents. To be had at this office and of all newsdealers.

FOR NEW ILLUSTRATED CATALOGUE OF FOOT Lathes, Scroll Saws, Small Steam Engines and Amateur's Tools, send stamp to Chase & Woodman, Newark, N. J.

SPANISH CEDAR
CIGAR-BOX LUMBER!
Finished Ready for Use.
First Quality at 3¾c. Second Quality at 2¾c.
POPLAR—1st Quality at $15 per M. Feet; 2d Quality at $13.50 per M. Feet.
BUNDLING AND CARTAGE ADDITIONAL.

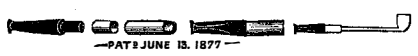
Above prices will remain until advised. No order received for less than 1,000 feet.

GEO. W. READ & CO.,
186 to 200 Lewis St., New York.



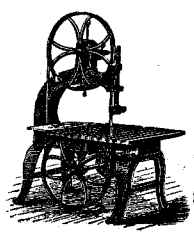
NILES ENGINE
SUITABLE FOR
COTTON GINS, CORN MILLS, GRAIN ELEVATORS, FARMS & PLANTATIONS, PRINTING OFFICES,
And for any purpose requiring an engine from 2 to 12 horse-power.
ADDRESS **NILES TOOL WORKS,**
Hamilton, Ohio.

THE TECHNOLOGY OF THE PAPER TRADE. By William Arnot, F.R.S. Its Early History. Invention of the Beating Engine, Introduction of Soda, etc., and the First Machine-made Paper. Cameron's Machine; the Fourdrinier Machine. Interesting sketch of the Old Time Paper-mill vs. the Mill of Modern Times, the latter described at length, with all the Apparatus; the Sorting, Boiling, Breaking, Poaching, and Beating Processes; Progress of the Pulp through the Machine; the Draining, the Rolls, the Cooling Rolls, the Size-bath. Raw Fibrous Materials, their Characteristics and Treatment Preparatory to Pulping. Cotton, Straw, Linen, Hemp, Esparto, Wood. Instructive Account of the Numerous Chemical and Boiling Processes, etc. This treatise gives Practical Particulars on every Department of Papermaking, describing the Latest and Best Processes and Machines in use, with Statistics, Profit, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos. **109** and **110.** Price 20 cents for the two. To be had at this office and of all newsdealers.



Spring mouth-piece for clay pipes and cigarettes. Horn, steel socket, coiled tube. Samples, 25c. Agents wanted. New French patent for same for sale.
E. S. MAY, Campbelltown, Steuben Co., N. Y.

PRUNING OF NEWLY-SET FRUIT Trees, with Careful Instructions for Cutting Back, etc., with 3 illustrations. Additional information on new Vegetables, Orchard Culture, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **109.** Price 10 cents. To be had at this office and of all newsdealers.



FIRST & PRYIBIL,
MACHINISTS,
And Manufacturers of
Wood Working Machinery,
461, 463, 465 & 467 West 40th St., New York.
Corner 10th Avenue.
Shaftings, Pulleys, Hangers, &c., of the latest improved styles.
Send for circular.

H. A. ROGERS, **MACHINISTS' SUPPLIES,**
19 John Street, N. Y. Best and Cheapest, EVERYTHING IN THE LINE.

WORK FOR ALL
In their own localities, canvassing for the **Fireside Visitor,** (enlarged) Weekly and Monthly. **Largest Paper in the World,** with Mammoth Chromos Free. Big Commissions to Agents. Terms and Outfit Free. Address **P. O. VICKERY, Augusta, Maine.**

WE ENAMEL
in FINE JET BLACK every variety of turned wood work parts of machinery, castings, tin ware and other metal work ENAMELED JET GOODS, in wood or metal, made to order
AMERICAN ENAMEL CO. 17 WARREN St PROVIDENCE, R. I.

GOLD WATCH and CHAIN ONLY **$20** *Cheapest in the World!* Sample WATCH and CHAIN *FREE* to Agents. C. M. LININGTON, 47 Jackson St., Chicago.

MADE TO ORDER.
Special Machinery, Tools, and Pat'd Articles. Estimates given. A. A. Pool & Co., 55 N. J. R. R. Ave., Newark, N. J.

THE DRIVEN WELL.
Town and County privileges for making **Driven Wells** and selling Licenses under the established **American Driven Well Patent,** leased by the year to responsible parties, by
WM. D. ANDREWS & BRO.,
NEW YORK.

The George Place Machinery Agency
Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

$2500 a year. Agents wanted everywhere. Business strictly legitimate. Particulars free Address J. WORTH & Co., St. Louis, Mo.

Brainerd MILLING MACHINES, all styles and sizes. Universal, Index, Gear Cutting, and Plain. Screw Machines and Vises. Address, for illustrated circular and prices, B. M. M. CO., 131 Milk St., Boston, Mass.

The **HOADLEY**
PORTABLE STEAM ENGINE.
WITH AUTOMATICAL CUT-OFF REGULATOR AND BALANCED VALVE.
THE BEST AND MOST ECONOMICAL ENGINE MADE
SEND FOR CIRCULAR.
The J. C. HOADLEY CO. LAWRENCE, MASS.
STATE WHERE YOU SAW THIS.

Second-Hand Microscopes.
Beck's, Crouch's, Ross', Nachet's Hartnack's, Zentmayer's and other makers, from 25 to 50 per cent. below the catalogue prices.
Glass slips and thin glass covers for mounting objects, at reduced price. Send for the list.
JAMES W. QUEEN & CO., OPTICIANS,
924 Chestnut St., Philadelphia.

Pond's Tools,
Engine Lathes, Planers, Drills, &c.
Send for Catalogue. DAVID W. POND, Successor to LUCIUS W. POND. **Worcester, Mass.**

$3 **GOLD PLATED WATCHES.** Cheapest in the known world. *Sample Watch Free to Agents.* Address, A. COULTER & Co., Chicago.

65 **MIXED CARDS,** with name, 10c. and stamp. Agent's Outfit, 10c L. C. COE & CO., Bristol, Ct.

EAGLE FOOT LATHES,

Improvement in style. Reduction in prices April 20th. Small Engine Lathes, Slide Rests, Tools, etc. Also Scroll and Circular Saw Attachments, Hand Planers, etc. Send for Catalogue of outfits for Amateurs or Artisans.
WM. L. CHASE & CO.,
95 & 97 Liberty St., New York.

IMPORTANT FOR ALL CORPORATIONS AND MANF'G CONCERNS.—**Buerk's Watchman's Time Detector,** capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular.
J. E. BUERK, P. O. Box 979, Boston, Mass
N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. A fine was assessed against them Nov. 11, 1876, for selling contrary to the order of the court. Persons buying or using clocks infringing on my patent will be dealt with according to law.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 414 Water St., N. Y. who control the patent for Green's American Driven Well.

$1200 **Salary.** Salesmen wanted to sell our Staple Goods to dealers. No peddling. **Expenses** paid. Permanent employment address S. A. GRANT & CO., 2, 4, 6 & 8 Home St., Cincinnati, O.

GUILD & GARRISON,
BEST STEAM PUMP, **FOR ALL PURPOSES.**
Brooklyn, E. D., New York.

EUREKA SAFETY POWER!

Practically **impossible to explode.** Tested to 900 lbs. pressure per square inch. 2-Horse Power, **$150,** 3 to 4 H. P., **$250.** Also, Stationary Engines and boilers, and **Spark Arresting Portable Engines** for plantation use. Send for our circular. Discount to the trade.
B. W. PAYNE & SONS,
Corning, N. Y.

$100 PER MONTH and EXPENSES or Commission to a few good men to sell our TEAS to DEALERS. NO PEDDLING. **YEARLY** Contract C. A. LONG & CO., Nos. 4 & 5 Fuller Block, Dearborn Street, Chicago, Ill.

PATENTS SOLD.
For terms, address EUROPEAN and UNITED STATES PATENT EXCHANGE, 200 Broadway, N. Y. Box 2801.

WROUGHT IRON BEAMS & GIRDERS

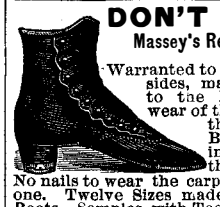
THE UNION IRON MILLS, Pittsburgh, Pa., Manufacturers of improved wrought iron Beams and Girders (patented).
The great fall which has taken place in the prices of Iron, and especially in Beams used in the construction of FIRE PROOF BUILDINGS, induces us to call the special attention of Engineers, Architects, and Builders to the undoubted advantages of now erecting Fire Proof structures; and by reference to pages 52 & 54 of our Book of Sections—which will be sent on application to those contemplating the erection of fire proof buildings—THE COST CAN BE ACCURATELY CALCULATED, the cost of Insurance avoided, and the serious losses and interruption to business caused by fire; these and like considerations fully justify any additional first cost. It is believed, that were owners fully aware of the small difference which now exists between the use of Wood and Iron, that in many cases the latter would be adopted. We shall be pleased to furnish estimates for all the Beams complete, for any specific structure, so that the difference in cost may at once be ascertained. Address
CARNEGIE, BROS. & CO., Pittsburgh, Pa.

Wood-Working Machinery,
Such as Woodworth Planing, Tongueing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

ADVERTISERS SELDOM FAIL TO MAKE MONEY
When their advertising is properly placed.
For list of best mediums, address
EDWIN ALDEN'S ADVERTISING AGENCY,
174 ELM STREET, CINCINNATI, O.
Best rates in the best papers.
Send for catalogue. Estimates and information free.

PATENT MINERAL WOOL.
Incombustible. The best non-conductor. For illustrated description see SCIENTIFIC AMERICAN of January 12th.
P. O. Box 4461. **A. D. ELBERS,** 26½ Broadway, N. Y.

DON'T FAIL TO USE
Massey's Revolving Shoe Heel Protector.



Warranted to wear the heel evenly on all sides, maintaining an upright tread to the Foot, and avoiding uneven wear of the Sole and Upper. It doubles the durability of Shoes and Boots, saves expense of reheeling, is *Noiseless,* does not Tire the Foot, and does not Slip. No nails to wear the carpet. Can be attached by any one. Twelve Sizes made, suitable for all Shoes and Boots. Samples, with Tool and Directions for applying, sent postpaid, on receipt of 50 cents. Liberal discounts to the Trade. N.B.—In ordering, send width of heel for proper size. Address
MASSEY REVOLVING SHOE HEEL CO.,
824 Broadway, New York.

WONDERFUL PEN AND HOLDER.
Write with water in letters of Gold, Silver, Violet, Blue, Black, Brown, Carmine, Yellow, etc. No ink required. Samples by mail 15c; one doz. by mail 75c. Magic Water Pens, any color desired, one doz. by mail 25c.; per gross, reduced rates. Two samples by mail 10c. The Cornetto, the new Italian musical instrument. Most wonderful and amusing invention. Samples by mail 25c. Agents wanted. Catalogue free. Empire Novelty Co., 309 B'way, N. Y.

WANTED SALESMEN for a wholesale house. Liberal salary; traveling expenses paid. Address R. & Co., box 1364, Cincinnati, Ohio.

Lathes, Planers, Shapers
Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

MODEL WORK—SEAL PRESSES.
STEEL NAME STAMPS,
WW. OLIVER BUFFALO. N.Y.

SECOND HAND ENGINES,
Portable and Stationary, at Low Prices.
HARRIS IRON WORKS, TITUSVILLE, PA.

AMATEUR CHUCK FOR LATHE OR Drill Work sent free for $5.50. Warranted or money returned. A. F. Cushman, Hartford, Ct. Sold by all dealers.

BIG 84 page Picture Book, **free.** My plan beats all to make money. Is easy, honest, and pays you $10 a day. DAVID C. COOK, Chicago, Ill.

25 **EXTRA NEW YEAR CARDS,** with 20 cts. Samples 3c. J. B. HUSTED, NASSAU, N. Y.

DUC'S IMPROVED ELEVATOR BUCKET.

For use in Flour Mills, Grain Elevators, Sugar Refineries, Malt Houses, Breweries, White Lead Works, &c. These buckets are made of Charcoal Iron, and are very strong and durable. No corners to catch, require less power to operate, and cost about the same as the old style bucket. Many thousands already sold. T. F. Rowland, Sole Manuf'r, Send for circular. Brooklyn, N. Y.

Patents and Standard Articles.
AGENCY OF ABOVE WANTED.
Address "R.," P. O. Box 2124, New Orleans, La.

25 **Snowflake Assorted Cards,** with name 10c. Outfit 10c. SEAVY BROS., Northford, Ct.

RIVAL STEAM PUMPS

NEW ILLUSTRATED CATALOGUE, 140 pages, on New Tools, Foot Lathes, Saws, Hand Drills, Small Engines, etc., sent on receipt of 3c. stamp for postage. **JACKSON & TYLER,**
16 German St., Baltimore, Md.

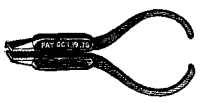
HENDERSON'S
COMBINED CATALOGUE OF
EVERYTHING
FOR THE
GARDEN
Numbering 175 pages, with Colored Plate, *sent free* to customers of past years, and to all purchasers of our books, either *Gardening for Profit, Practical Floriculture* or *Gardening for Pleasure* (price $1.50 each, prepaid, by mail). To others, on receipt of 25c. Plain Plant or Seed Catalogues, without Plate, free to all.
PETER HENDERSON & CO.
Seedsmen, Market Gardeners, and Florists,
35 Cortlandt Street, New York.

AIR COMPRESSORS
FOR ALL PURPOSES.
A SPECIALTY OF HEAVY PRESSURES.
THE NORWALK IRON WORKS CO.,
SOUTH NORWALK, CONN.

SALESMEN WANTED **$125** A Month and Expenses selling to DEALERS SAMPLES FREE. Send 3c. STAMP to insure answer. S. FOSTER & CO. Cincinn'ti, O. **CIGARS**

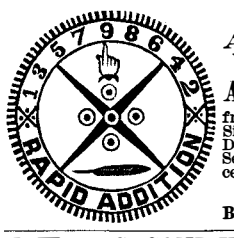
NEW ROAD LOCOMOTIVES, BY Marshall, Sons & Co. General description and one engraving. SUPPLEMENT No. **56.** 10 cents.

PARALLEL



Send for Price List to
HAGSTOZ & THORPE, Sole Manufacturers,
Sixth and Chestnut Sts., Philadelphia, Pa.

FORCE OF WIND. HOW TO ESTIMATE the Necessary Strength of Roofs, Towers, Tall Chimneys, etc., to withstand the Wind. The Solution of all Problems of the kind, with numerous Formula. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **109.** Price 10 cents. To be had at this office and of all newsdealers.

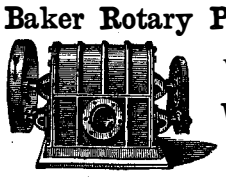


RAPID ADDITION!
Wonderful Invention.
ART of Adding Figures from left to right; or from Middle either way; or Six Columns at one time! Done as quick as Thought! Sent to any address on receipt of Price, 1 dollar.
WILLIAM FURNISS.
Batavia, Genesee Co., N. Y.

NEW AND SECOND-HAND MACHINERY is now offered by us at a very great reduction in price, for the purpose of closing up our business. Machinists' Tools, consisting of Engine Lathes from 42-inch swing down to 15 inch swing; Iron Planers; Drills; Radial, Column, and Post Shapers; Universal Milling Machines; Gear Cutters; and machines for making cutters.
Wood-working Machinery; Woodworth Planers, both light and heavy; Farrar Planers from 24 inches to 28 inches wide; Daniels' Planers; Tenon Machines; Sash and Moulding Machines; Single and Double Spindle Friezers; Scroll and Band Saws; Weather-board and Cross-cut Saws; Wood Turner's Lathes, &c., &c. Send for descriptive catalogue to STEPTOE, McFARLAN & CO., 214 West 2d Street, Cincinnati, Ohio.

50 **Best** Mixed Cards, with name, in case, 13c., or 25 no 2 alike, 10c. Outfit 10c. Dowd & Co., Bristol, Ct.

Baker Rotary Pressure Blower.
(FORCED BLAST)



Warranted superior to any other.
WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA.

MECHANICAL DRAWING.—BY PROF. C. W. MacCord. A series of practical lessons in Mechanical Drawing, accompanied by carefully prepared examples for practice, with directions, all of simple and plain character, intended to enable any person, young or old, skilled or unskilled, to acquire the art of drawing. No expensive instruments are involved. Any person with slate or paper may rapidly learn. The series embodies the most abundant illustrations for all descriptions of drawing, and forms *the most valuable treatise upon the subject ever published, as well as the cheapest.* These instructions are contained in SUPPLEMENTS Nos. **1, 3, 4, 6, 8, 9, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46 47, 48.** Price 10 cts. each; or, $3 for the entire series of thirty-three numbers. To be had at this office and of all newsdealers.

CODY' PAT. SHAFT OILERS. OIL FEEDER &c
Adr: CINCINNATI BRASS WORKS

Can I Obtain a Patent?

This is the first inquiry that naturally occurs to every author or discoverer of a new idea or improvement. The quickest and best way to obtain a satisfactory answer, without expense, is to write to us (Munn & Co.), describing the invention, with a small sketch. All we need is to get the *idea.* Do not use pale ink. Be brief. Send stamps for postage. We will immediately answer and inform you whether or not your improvement is probably patentable; and if so, give you the necessary instructions for further procedure. Our long experience enables us to decide quickly. For this advice we make *no charge.* All persons who desire to consult us in regard to obtaining patents are cordially invited to do so. We shall be happy to see them in person at our office, or to advise them by letter. In all cases, they may expect from us a careful consideration of their plans, an honest opinion, and a prompt reply.

What Security Have I that my communication to Munn & Co. will be faithfully guarded and remain confidential?

Answer.—You have none except our well-known integrity in this respect, based upon a most extensive practice of thirty years' standing. Our clients are numbered by hundreds of thousands. They are to be found in every town and city in the Union. Please to make inquiry about us. Such a thing as the betrayal of a client's interests, when committed to our professional care, never has occurred, and is not likely to occur. All business and communications intrusted to us are kept *secret and confidential.*

Address **MUNN & CO.,**
Publishers of the SCIENTIFIC AMERICAN,
37 Park Row, New York.

© 1878 SCIENTIFIC AMERICAN, INC

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

MARVIN'S
FIRE & BURGLAR
SAFES
COUNTER PLATFORM WAGON & TRACK
SCALES
MARVIN SAFE & SCALE CO.
265 BROADWAY. N.Y.

ESTABLISHED 1844.

JOSEPH C. TODD,

(Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. Also Agent for the celebrated and improved Rawson & Rittinger Hoisting Engine, I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price Address

J. C. TODD,
10 Barclay St., New York, or Paterson, N. J.

Jarvis Gas Consuming Furnace.

For Setting Steam Boilers. Will burn screenings with small mixture of soft coal without blower, also *green wet peat*. Three boilers set this way will make as much steam as five old way. Address A. F. UPTON, Agent,
Boston, Mass.

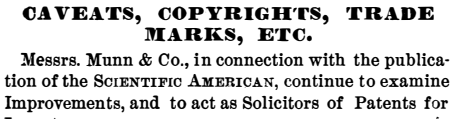
PATTERN LETTERS FOR MARKING ON PATTERNS FOR CASTINGS. KNIGHT BROS. SENECA FALLS N.Y.

Steel Castings,

From ¼ to 10,000 lbs. weight, true to pattern. An invaluable substitute for forgings, or for malleable iron castings requiring great strength. Send for circular and price list to CHESTER STEEL CASTING COMPANY, EVELINA STREET, PHILADELPHIA, PA.

Working Models

And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Centre St., N. Y.



CAVEATS, COPYRIGHTS, TRADE MARKS, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Trade Mark Regulations, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on ve y moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Trade Marks, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents, sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

GUARDIOLA'S
COFFEE & SUGAR MACHINERY

Coffee, Malt, Corn, Cocoa, and Grain-Drying Machine. Coffee-Hulling and Polishing Machines. Coffee-Washing Machine. Helix Sugar Evaporator.

Messrs. C. ADOLPHE LOW & CO., 42 Cedar Street, **Messrs. MUNOZ & ESPRIELLA,** 52 Pine Street, New York, are Mr. Guardiola's Agents, and they will give prompt attention to all orders for any of the above machines.

Harrison's System of Grinding!

Illustrated Catalogue Now Ready.
NEW STANDARD FLOURING MILLS.
Old Theories, Horizontal Grinders, Slow Runners, Fully Exploded. Fine Flour, High Speed, and Economical Milling Fully Established.
A NEW Copy For All.
Millers and Editors please address
EDWARD HARRISON,
No. 135 Howard Ave. New Haven, Conn.

Steel Name Stamps.

N. Y. STENCIL WORKS, 87 Nassau St., N. Y.

Cut Brass Gears, list free. Grant, 194 Beverly St., Boston.

ROCK DRILLING MACHINES AND AIR COMPRESSORS.
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG MASS.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalo ue.
J. T. NOYE & SON, Buffalo, N. Y.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

WATSONS NON CHANGEABLE GAP LATHE HAS A GREAT FACILITIES FOR LARGE OR MEDIUM SIZE WORK JAMES WATSON MANR 1508 S. FRONT ST. PHILA. PA. U.S.A.

BOILER COVERINGS

SAVE 10 TO 20 PER CENT.
THE CHALMERS SPENCE CO., Foot East 9th St, New York.

KNOW THYSELF A new Medical Treatise, "THE SCIENCE OF LIFE, OR SELF-PRESERVATION," a book for everybody. Price **$1**, sent by mail. Fifty original prescriptions, either one of which is worth ten times the price of the book. Gold Medal awarded the author. The Boston Herald says: "The Science of Life is beyond all comparison, the most extraordinary work on Physiology ever published." An Illustrated Pamphlet sent FREE. Address DR. W. H. PARKER, No. 4 Bulfinch St eet, Boston, Mass. **HEAL THYSELF**

PUNCHING PRESSES. Drop Hammers and Dies, for working Metals, &c. THE STILES & PARKER PRESS CO., Middletown, Conn.

1878. BILLIARD TABLES 1878.

BUY THE BEST AT HEADQUARTERS with the celebrated PHELAN & COLLENDER COMBINATION CUSHIONS, which will be sold on tables of my manufacture only in future, as I will not furnish them to any other manufacturer. The finest tables, balls, cloth, cues, &c., at lowest prices—send for catalogue and reduced price list. H. W. COLLENDER, 738 Broadway, New York, Successor to Phelan & Collender.

CIRCULAR SAW-MILLS, POWDER-KEG and Wire-drawing Machinery manufactured at
S. HEALD & SONS',
Send for prices, etc. Barre, Mass.

H. R. WORTHINGTON,
239 BROADWAY, NEW YORK.
Hydraulic Works, Van Brunt Street, Brooklyn, Manufactures Pumping Engines for Water Works. In daily use at 100 stations. Also Steam Pumps, Water Motors and Water Meters. See SCIENTIFIC AMERICAN SUPPLEMENT, January 27th, 1877. Prices largely reduced July 1ts, 1877.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

TO INVENTORS AND MANUFACTURERS

FOLLOWS & BATE, Manchester, England, Hardware and Machinery Merchants, are prepared to buy American Goods for Cash, and to act as Sole Wholesale Agents.

DROP FORGINGS and SPECIAL MACHINERY, THE HULL & BELDEN CO., Danbury, Conn.

DAMPER REGULATORS **BEST** AND WEIGHTED GAUGE COCKS.
MURRILL & KEIZER, 44 HOLLIDAY ST., BALTIMORE.

FOR ALL KINDS OF MACHINERY—Apply to S. C. HILLS, 78 Chambers St., New York.

ROOTS' PATENT PORTABLE FORGE.

ADAPTED TO EVERY VARIETY OF WORK.

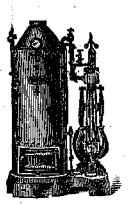
THE ONLY FORGE WITH FORCE BLAST BLOWER.

THE ONLY EFFECTIVE FORGE MADE.

P. H. & F. M. ROOTS, Manuf'rs, CONNERSVILLE, IND.
S. S. TOWNSEND. Gen'l Ag't, 6 Cortlandt St., NEW YORK.

BONE MILLS.

The best in the world. 5 sizes, adapted perfectly for Crushing and Grinding Minerals and all hard substances. Grinding surfaces quickly and cheaply renewed. Send for descriptive pamphlet.
BAUGH & SONS,
PHILADELPHIA, PA.



2 H. P. Boiler and Engine, $175.
3 H. P., $200.
LOVEGROVE & CO.,
125 North 4th Street,
Philadelphia, Pa.,
Builders of Engines and Boilers, 2 to 100 H. P. Send for circulars and price lists.

WIRE ROPE

Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York.
Wheels and Rope for conveying power long distances. Send for circular.

25 NEW YEAR CARDS, with name, 20c. **25** Extra Mixed, 10c. Geo. I. Reed & Co., Nassau, N.Y.

NATIONAL STEAM PUMP,

Adapted to every possible duty.
Reduced price, embodying latest improvements.
W. E. KELLY & BRO.,
46 Cortlandt St., New York.

"OLD RELIABLE." TO KNOW ALL about the **Best Pump** for Paper Makers, Tanners, Contractors, and for irrigation, send for illustrated pamphlet, 78 pages. HEALD, SISCO & CO., Baldwinsville, N.Y.

STEAM ENGINES.
We build the best Portable or Farm Engines in the world. More power with less water and fuel than any others. Low prices. We have the largest line of Engine Patterns in the U. S. Foreign correspondence solicited. TAYLOR M'F'G CO., Westminster, Md., Successors to Utica Steam Engine Co., formerly Wood & Mann, of Utica, N. Y. Good, responsible Agents wanted in territory not taken.

MINE ACCIDENTS. MECHANICAL APpliances for use in case of Explosions, etc. By CHAS. HAWKSLEY and EDWARD B. MARTEN. A paper read before the Institution of Mechanical Engineers. Eighteen illustrations of the most approved apparatus for quickly discharging water from mines, promptly restoring Ventilation, etc., namely: the Pulsometer, the Steam Ejector, the Centrifugal and other Pumps, combined Boiler, Engine, and Air Compressor; Air Lock, and Portable Winding Gear. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 105. Price 10 cents. To be had at this office and of all newsdealers.

Anderson's Safety Inkstand.—Don't spill, spoil pens, or soil fingers. Over 150,000 sold. Sent in exchange for old books, or *free* on easy conditions. Send postal card to *American Book Exchange*, 55 Beekman St., N. Y.

AGENTS WANTED. Package of Goods *free to every applicant*. Star Novelty Co., Charlotte, Mich.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
GEO. PLACE, 121 Chambers St., New York Agent.

1872, 1874, 1875,
SCIENCE RECORD.

A few copies of these splendid books are offered at the following very low prices.
Among the subjects, the following are the most noteworthy, exhibiting in a condensed form a general account of the Progress of the World:

CHEMISTRY AND METALLURGY,
MECHANICS AND ENGINEERING,
ELECTRICITY, LIGHT, HEAT, SOUND.
TECHNOLOGY, THE USEFUL ARTS,
BOTANY AND HORTICULTURE,
AGRICULTURE,
RURAL AND HOUSEHOLD ECONOMY,
MATERIA MEDICA, THERAPEUTICS, HYGIENE,
NATURAL HISTORY AND ZOOLOGY,
METEOROLOGY, TERRESTRIAL PHYSICS,
GEOGRAPHY,
GEOLOGY AND MINERALOGY,
ASTRONOMY,
BIOGRAPHY AND NECROLOGY.

Each yearly volume contains about 600 octavo pages, including a large number of handsome engravings. They are bound in substantial and handsome bindings, and will be mailed on receipt of $1.25 each. Address
MUNN & CO., PUBLISHERS,
37 Park Row, New York city.

H. W. JOHNS' PATENT.
ASBESTOS
MATERIALS.

Liquid Paints—all shades, finest in the world.
Fire Proof Paint, for Wood work, &c.
Roof Paint, for Tin Roofs, Iron Work, &c.
Roofing, with white Fire Proof Coating.
Roof Coating, for restoring and preserving old roofs.
Cements, for Retorts, Furnaces, Leaky Roofs, &c.
Steam Pipe and **Boiler Coverings.**
Steam Packing, Asbestos Boards, Fire Proof Coatings, Sheathings and Roofing Felts, &c.
These articles are ready for use, and can be easily applied by any one. Send for Samples, Pamphlets, Price Lists, &c.
H. W. JOHNS MANUFACTURING COMPANY,
87 Maiden Lane, New York.
Also for sale by
PHILADELPHIA BRANCH, 406 Arch St.
DOWNIE, TRAINER & CO., Boston.
S. W. HEMPSTED & CO., Columbus, Ohio.
M. M. BUCK & CO., St. Louis.
C. A. PARKER & CO., New Orleans.
THOMPSON & UPSON, San Francisco.

THE
Scientific American.

The Most Popular Scientific Paper in the World.
THIRTY-THIRD YEAR.

Only $3.20 a Year including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row New York.

MEN OF PROGRESS.

This large, rare, and splendid STEEL-PLATE ENGRAVING, entitled "Men of Progress," is one of the finest art-works of the day, possessing a rare and peculiar value over ordinary pictures, by reason of the life-like accuracy of the personages it represents. The scene of the picture is laid in the great hall of the Patent Office at Washington. The grouping is spirited and artistic. Among the persons represented are the following eminent Inventors:

S. F. B. MORSE.....Electric Telegraph.
CYRUS H. McCORMICK.....Reaper.
THOS. BLANCHARD.....Lathe for Irregular Forms.
WILLIAM T. G. MORTON.....Chloroform.
SAMUEL COLT.....Revolving Fire-Arms.
CHARLES GOODYEAR.....Rubber Fabrics.
FREDERICK E. SICKELS.....Steam Cut-Off.
HENRY BURDEN.....Horse Shoe Machine.
JOHN ERICSSON.....First Monitor.
JAMES BOGARDUS.....Iron Buildings.
JOSEPH SAXTON.....Watch Machinery.
PETER COOPER.....Iron-Rolling Machinery.
JOSEPH HENRY.....Electro-Magnetic Machines.
ISAIAH JENNINGS.....Friction Matches.
RICHARD M. HOE.....Fast Printing Presses.

The picture, which is *three feet long and two feet high*, forms an enduring and desirable object for the adornment of the parlor and library. It was engraved by the celebrated JOHN SARTAIN, from a large painting by SCHUSSELE, and all the portraits were taken from life.
Price $5. Put up in stiff rolled paper cases, and sent by mail, postage free, to all parts of the country, on receipt of price. Address

MUNN & CO.,
37 Park Row, New York city.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.

© 1878 SCIENTIFIC AMERICAN, INC